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THE BEHAVIOR OF PRICES

By

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INCORPORATED

With a Foreword by

EDWIN F. GAY and WESLEY C. MITCHELL
Directors of Research

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FOREWORD

Among the publications of the National Bureau of Economic Research, this work stands in a rather special category. The previous studies of the National Bureau, we may hope, have extended the frontiers of knowledge, but this undertaking more decidedly than its predecessors, opens new paths. On such a scale, it is the pioneer effort, to explore, with all available statistical instruments, the recesses of the labyrinth of prices. It will not only furnish clues and new starting-points for further explorations, but, long after its immediate initiative has had its effect, we believe that it will remain a signal achievement in the history of scientific research.

With all its special individual significance, this investigation belongs not only in method and spirit but also in its inception to the same family in which are ranged the related studies of the National Bureau. It lies close to the work on business cycles which is one of the chief concerns of this group of economists. The analysis of the recurrent fluctuations of business activity led directly to a close examination not only of one important aspect of price relationships but of the whole system of prices and its internal structure. The directors of research of the National Bureau, nearly three years ago, were considering the attractions and the difficulties of the wider problem when they learned that among the few well-equipped statisticians who had already initiated research in this little-explored field was Dr. Frederick C. Mills of Columbia University. The National Bureau promptly offered him its facilities, and this notable volume is the first fruit of that collaboration.

The attentive reader of the following pages—and they are obviously addressed to that distinguished person—will perceive that Dr. Mills has progressed logically and methodically, from section to section and chapter to chapter. So far, therefore, as this first volume pursues the analysis of price relationships, it is a unified whole; but it is, nevertheless, only a finished portion of what has been planned and is now proceeding. It needs to be supplemented by the examination of certain important component elements of the price system and their relationships—

53006

problems with which a second volume will deal. For the sake of the rounded presentation of the subject there might have been some advantages in postponing the publication of the four chapters herewith presented until the work on the second volume had been completed. Both practical and scientific considerations, however, outweighted the aesthetic argument. The work of the National Bureau is continuous and its publications on national income and business cycles are already of a serial character. The comment and criticism which each publication enjoys from members of the staff and from the Directors of the organization are reënforced from the wider scientific public. It is a reciprocal service which a body of investigators owes and receives.

The attentive and inquiring reader may also look to the second volume for some marshalling and review of the evidence here gathered for or against the provisional working hypothesis which underlies this work, namely that, despite the apparent haphazard variability of relationships, there is in fact an orderly universe of prices, in which there prevail discoverable "laws." In the present state of the science, certitude is not attainable; but the present installment of the inquiry opens new glimpses of regularities of trends in time and space which both justify the effort and act as spur to fresh endeavor. It is clear that this generation of scientific observers in the social sciences must operate with a measured or measurable base-line which is too short in time and too narrow in content, and this is particularly true of the statistical material, covering only wholesale prices for a few recent decades, which is available for this study. But it is worth while to make a serious beginning, and this Dr. Mills has done.

Edwin F. Gay,
Wesley C. Mitchell,
Directors of Research.

RESOLUTION

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Adopted Oct. 25, 1926.

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In the conduct of this investigation I have received counsel and criticism from all the members of the Research Staff of the National Bureau. The Directors of Research, in particular, have given me generous aid at all stages of the study. I am indebted to Dr. Henry Schultz, of the University of Chicago, for a critical reading of the manuscript and for suggestions on specific points. The United States Bureau of Labor Statistics, through Commissioner Ethelbert Stewart, has responded cordially to many requests for information from its files and has made possible the publication of the detailed descriptions of price quotations which are given in Appendix Table I. Sincere thanks are due, finally, to Miss Maude Remey and Miss Mildred Uhrbrock, my assistants in all the major tasks of this enterprise.

FREDERICK C. MILLS.

CONTENTS

Page
INTRODUCTION 31

CHAPTER I

MEASURABLE CHARACTERISTICS OF COMMODITY PRICES

SECTION
I. PRICE CHANGES BETWEEN SPECIFIC DATES 37
II. VARIABILITY OF COMMODITY PRICES 39
  1. The Measurement of Monthly Variability 39
  2. The Measurement of Year-to-Year Variability 49
    a. Year-to-Year Variability of Wholesale Prices 50
    b. Year-to-Year Variability of Retail Prices 52
    c. Year-to-Year Variability of Farm Prices 53
  § Week-to-Week Variability 55
  3. Measurement of the Frequency of Monthly Price Changes . . 56
  § Other Measures of Price Variability 60
III. TRENDS OF COMMODITY PRICES 65
  1. The Measurement of Price Trends 66
  2. The Measurement of Trends in Purchasing Power 69
  § Rates of Change in the Earnings of American Workers . . . 72
  3. On "Normal" Relations between Commodity Prices . . . 73
IV. TIMING, DURATION AND AMPLITUDE OF INDIVIDUAL PRICE CHANGES DURING GENERAL PRICE MOVEMENTS 76
  1. The Measurement of Cyclical Fluctuations in Commodity Prices . 77
    a. The Timing of Revival and Recession 78
    b. Interpretation of Typical Results 82
  § The Measurement of Cyclical Price Movements: Special Cases . 89
  2. Cycles in Commodity Prices: General Measures 90
    a. Number of Price Cycles Recorded 91
    b. The Duration of Cycles in Commodity Prices 94
    c. Cyclical Variability of Commodity Prices 96
  3. Behavior of Commodity Prices during Revival 97
    a. Degree of Conformity to General Price Movements during Revival 98
    b. Sequence of Change in Commodity Prices during Revival . . 99
    c. Duration of Periods of Rising Prices 107
  4. Behavior of Commodity Prices during Recession 115
    a. Degree of Conformity to General Price Movements during Recession 115
    b. Sequence of Change in Commodity Prices during Recession . 116
    c. Duration of Periods of Falling Prices 126
  5. Relations among Measures of Cyclical Price Movements . . . 127
    a. Relations between Measures of Cylical Variability and Other Cyclical Measures 128
    b. Relations between the Time of Revival and Other Cyclical Measures 130

SECTION Page

c. Relations between the Time of Recession and Other Cyclical Measures . . . 132
d. Relations among Other Measures of Cyclical Price Movements 134
e. Consistency of the Sequence of Price Movements during Revival and Recession . . . 134

V. RELATIONS BETWEEN PRICES AND PRICE-DETERMINING FACTORS: PRICE FLEXIBILITY . . . 140
1. Measures Needed in Defining the Relationship between Prices and Price-Determining Factors . . . 140
§ Coefficients of Partial Flexibility of Prices . . . 143
2. The Relation between the Price and Production of Hay in the United States . . . 144
3. The Relation between the Price and Per Capita Consumption of Potatoes in the United States . . . 148

VI. RELATIONS AMONG COMMODITY PRICE CHARACTERISTICS . . . 151

VII. SUMMARY . . . 155

CHAPTER II

REGIONAL DIFFERENCES IN COMMODITY PRICES AND IN PRICE BEHAVIOR

I. REGIONAL DIFFERENCES IN PRICES . . . 162
1. Regional Differences in Wholesale Prices . . . 162
a. Building Materials . . . 162
b. Gasoline . . . 167
2. Regional Differences in Retail Prices . . . 173
a. Foods . . . 173
b. Coal, Gas and Electricity . . . 173
c. Dry Goods . . . 175
3. Regional Differences in Farm Prices . . . 175
§ Regional Differences in Discount Rates . . . 180

II. REGIONAL DIFFERENCES IN PRICE BEHAVIOR . . . 186
1. Regional Differences in Degree of Price Change between Given Dates 187
2. Regional Differences in the Variability of Prices . . . 189
a. Year-to-Year Variability . . . 189
b. Monthly Variability . . . 192
§ Regional Differences in the Monthly Variability of Discount Rates . . . 194
c. Frequency of Price Change . . . 196
3. Regional Differences in Commodity Price Trends . . . 198
4. Regional Differences in the Cyclical Movements of Commodity Prices 201
5. Regional Differences in the Flexibility of Commodity Prices . . . 208

III. CONCLUSION . . . 210

CHAPTER III

THE MEASUREMENT OF PRICE INSTABILITY: PRICE RELATIVES IN COMBINATION

I. PRICE RELATIONS AND ECONOMIC PROCESSES: PRICE INSTABILITY . . . 213
1. The Price System . . . 213

SECTION Page
2. The Nature of Price Stability and Instability 214
a. Instability of the Price Level 214
b. Internal Instability: Alterations in the Relations among Prices . 215
c. The Population of Prices and the Problem of Group Stability . 216
3. Problems Relating to Commodity Prices in Combination . . 217
II. THE DESCRIPTION OF PRICE RELATIVES IN COMBINATION 219
1. Frequency Distributions of Price Relatives 219
2. Weights 221
3. Significance of Frequency Distributions of Price Relatives . . 223
§ Note on the Description of Frequency Distributions . . . 227
III. CHANGES IN THE LEVEL OF WHOLESALE PRICES 229
1. Comparison of Index Numbers 229
§ Price Trends and Bias in Index Numbers 238
§ Reliability of Index Numbers 240
2. A Monthly Price Index: Changes in the Price Level over Twelve-Month Intervals 247
IV. PRICE DISPERSION 251
1. Nature and Significance of Price Dispersion 252
2. The Measurement of Price Dispersion 256
3. Annual Indexes of Price Dispersion, 1890-1926. 263
§ An Index of Dispersion Based on Group Index Numbers . . . 269
4. Monthly Indexes of Price Dispersion, 1906-1908, 1920-1927 . . 270
5. The Dispersion of Prices and Changes in the Price Level . . 279
V. PRICE DISPLACEMENT 286
1. The Measurement of Price Displacement 287
2. The Displacement of Fixed Base Relatives with Reference to a Constant Criterion 289
3. The Displacement of Fixed Base Relatives with Reference to the Preceding Year as Criterion 298
4. The Displacement of Two-Year Link Relatives with Reference to the Preceding Year as Criterion 301
5. Monthly Measures of Price Displacement 306
VI. ON THE CHARACTERISTICS OF THE POPULATION OF PRICES . . . 311
1. The Description of Populations in Terms of Group Characteristics: Criteria of Curve Type 311
§ Types of Frequency Distributions 313
§ Criteria of Instability 321
2. Characteristics of Frequency Distributions of Price Relatives . . 323
§ Comparisons of Distributions of Price Relatives 325
Arithmetic and Logarithmic Distributions 325
Weighted and Unweighted Distributions 329
Distributions of Fixed Base and Link Relatives 331
§ Note on the Form of Frequency Distributions of Price Relatives . 337
3. Chronological Changes in the Characteristics of Frequency Distributions of Price Relatives 338
§ Changes in the Characteristics of Frequency Distributions of Unweighted Fixed Base Relatives 339

SECTION — Page
§ Changes in the Characteristics of Frequency Distributions of Weighted Link Relatives 348
VII. RELATIONS AMONG MEASURES OF PRICE INSTABILITY 355
VIII. SUMMARY 364

CHAPTER IV

MEASURES OF PRICE BEHAVIOR IN COMBINATION

I. GROUP CHARACTERISTICS OF MEASURES OF PRICE VARIABILITY AND TREND 370
1. Measures of Monthly Variability of Wholesale Prices, in Combination 370
2. Measures of Year-to-Year Variability of Wholesale Prices, in Combination 377
3. Measures of Frequency of Price Change, in Combination . . 379
4. Measures of Price Trends, in Combination 381
§ Comparison of Distribution Types 383
II. GROUP CHARACTERISTICS OF MEASURES OF CYCLICAL PRICE MOVEMENTS 386
1. The Extent of Commodity Price Changes during Business Cycles . 387
2. Comparison of Price Cycles, 1890-1925, in Respect to their Major Characteristics 395
a. The Timing of Revival and Recession in Commodity Prices . . 395
§ Price Movements, 1919-1923 403
b. The Duration of Periods of Price Revival and Recession . . 405
c. The Degree of Price Change during Revival and Recession . . 413
d. The Duration of Cycles in Commodity Prices 421
e. The Amplitude of Cycles in Commodity Prices 426
§ Comparison of Distribution Types 431
III. SUMMARY 433
APPENDIX 443
INDEX 587

The titles of certain sections which contain supplementary notes and findings, or which deal with somewhat technical (although not unimportant) matters, are designated by the symbol § . These sections are printed in distinctive type.

LIST OF TABLES

Table — Page

1. Average Annual Prices of Hides, at Wholesale, 1890-1926 38
2. Average Monthly Prices of Print Cloths, at Wholesale, 1925 . . . 39
3. Measures of Monthly Variability of Print Cloth Prices, by Years, 1890-1926 40
4. Measures of Monthly Variability of Prices of Selected Commodities, at Wholesale, by Periods, 1890-1925 45
5. Measures of Monthly Variability of Six Economic Series, 1890-1925 . . 45
6. Measures of Year-to-Year Variability of the Prices of Selected Commodities, at Wholesale, and of Six General Economic Series . . . 51
7. Measures of Year-to-Year Variability of Food Prices, at Retail . . . 52
8. Measures of Year-to-Year Variability of Farm Prices of Selected Agricultural Products 53
9. Relative Variability of Prices of Six Farm Products in Specific States and in Chicago 54
10. Measures of Frequency of Monthly Changes in Prices of Selected Commodities, at Wholesale, by Periods, 1890-1925 58
11. Measures of Price Variability for Wheat, Barley and Oats 61
12. Measures of Year-to-Year Variability of the Prices of Five Grains . . 63
13. Measures of Monthly Variability of the Prices of Five Grains . . . 64
14. Average Annual Rates of Change in Prices and Purchasing Power of Selected Commodities, at Wholesale, and in Seven General Economic Series, 1896-1913 67
15. Average Annual Rates of Change in Money Earnings and Real Earnings of Employed American Workers, 1896-1913 73
16. Average Annual Rates of Change in Money Earnings and Real Earnings of Workers in Main Groups of Manufacturing Industries, 1896-1913 . . 73
17. Dates of Turning Points in American Price Cycles, and Limits Employed in Studying Cyclical Turns in Commodity Prices 81
18. Measures Describing the Behavior of Wholesale Prices of Fifteen Commodities and of Seven General Economic Series during Periods of Revival and Recession in American Business, 1890-1925 83
19. Summary of Cyclical Movements in the Prices of Pig Iron, 1890-1925 . . 84
20. Timing, Duration and Amplitude of Cyclical Movements in an Index Number of Wholesale Prices and in Pig Iron Prices, 1890-1925 . . 87
21. Averages Relating to the Timing, Duration and Amplitude of Cyclical Movements in the Wholesale Prices of Fifteen Commodities and in Seven General Economic Series, 1890-1925 92
22. Ranking of Fifteen Commodities according to the Number of Cycles Observable in their Price Movements, 1890-1925 94
23. Ranking of Fifteen Commodities according to the Average Duration of Price Cycles, 1890-1925 95
24. Ranking of Fifteen Commodities according to the Cyclical Variability of their Prices, 1890-1925 96
25. Summary: Behavior of All Commodities during Price Revivals . . . 99
26. Sequence of Revival in the Prices of Fifteen Commodities, at Wholesale . 100

Table		Page
27.	Sequence of Revival in Seven Economic Series	101
28.	Sequence of Revival in the Prices of Sixty Six Commodities, at Wholesale (Commodities Selected on the Basis of Consistency)	103
29.	Sequence of Revival in the Prices of Twenty Commodities, at Wholesale. (Commodities Selected on the Basis of Consistency)	105
30.	Ranking of Eighty Four Commodities according to the Consistency of their Price Movements during Business Revivals	106
31.	Ranking of Fifteen Commodities according to Average Duration of the Period of Rising Prices	108
32.	Ranking of Seven Economic Series according to the Average Duration of the Period of Rise	108
33.	Ranking of 150 Commodities according to the Percentage Relation of the Average Period of Rising Prices to the Average Length of the Price Cycle	111
34.	Summary: Behavior of All Commodities during Price Recessions	116
35.	Sequence of Recession in the Prices of Fifteen Commodities, at Wholesale	116
36.	Sequence of Recession in Seven Economic Series	117
37.	Sequence of Recession in the Prices of Sixty Six Commodities, at Wholesale. (Commodities Selected on the Basis of Consistency during Revival)	119
38.	Sequence of Recession in the Prices of Sixty Six Commodities, at Wholesale. (Commodities Selected on the Basis of Consistency during Recession)	121
39.	Sequence of Recession in the Prices of Twenty Commodities, at Wholesale. (Commodities Selected on the Basis of Consistency during Recession)	123
40.	Ranking of Eighty Four Commodities according to the Consistency of their Price Movements during Business Recessions	124
41.	Ranking of Fifteen Commodities according to the Average Duration of the Period of Price Decline	126
42.	Relationships among Measures of Cyclical Price Movements	128
43.	Relations between Cyclical Variability and Other Cyclical Price Characteristics	129
44.	Relations between the Time of Revival and Other Cyclical Price Characteristics	131
45.	Relations between the Time of Recession and Other Cyclical Price Characteristics	133
46.	Relations between the Average Time of Revival in Commodity Price Series and the Times of Revival during Specific Cycles	135
47.	Relations among the Times of Revival in Commodity Prices during Successive Cycles	136
48.	Relations between the Average Time of Recession in Commodity Price Series and the Times of Recession during Specific Cycles	137
49.	Relations among the Times of Recession in Commodity Prices during Successive Cycles	138
50.	Prices and Production of Hay in the United States, 1890-1925 (by Crop Years)	146
51.	Prices and Estimated Per Capita Consumption of Potatoes in the United States, 1890-1913 (by Crop Years)	148

TABLE PAGE
52. Relations between Year-to-Year Variability and Other Characteristics of Individual Commodity Prices 152
53. Relations between Monthly Variability and Other Characteristics of Individual Commodity Prices 153
54. Relations between the Frequency of Monthly Price Change and Other Characteristics of Individual Commodity Prices 154
55. Relations between the Average Annual Rates of Increase and Other Characteristics of Individual Commodity Prices 154
56. Regional Differences in Building Material Prices 164
57. Average Monthly Prices with Measures of Regional Differences in the Prices of Portland Cement, at Wholesale, in Ten American Cities, 1919-1924 166
58. Average Wholesale Prices and Measures of Regional Differences in the Prices of Gasoline in Fifty Cities at Seven Dates 167
59. Average Monthly Prices with Measures of Regional Differences in the Prices of Tank Wagon Gasoline, at Wholesale, in Ten American Cities, 1919-1927 169
60. Regional Differences in Food Prices, at Retail 172
61. Regional Differences in the Prices of Coal, Gas and Electricity, at Retail . 174
62. Regional Differences in Retail Prices of Dry Goods 175
63. Regional Differences in Farm Prices of Seven Agricultural Products . . 176
64. December Farm Prices of Seven Agricultural Products 178
65. Relative Measures of Regional Differences in Farm Prices of Seven Agricultural Products 179
66. Average Discount Rates on Customers' Loans in American Cities, with Measures of Regional Differences, 1918-1927 180
67. Discount Rates on Customers' Loans. Average Rates in Thirty Four American Cities, 1922-1926 184
68. Regional Differences in Discount Rates and in Selected Commodity Price Series 186
69. Regional Differences in the Degree of Change in Cost of Living in the United States between 1914 and 1927 189
70. Regional Differences in Year-to-Year Variability of Farm Prices of Corn, 1889-1913 189
71. Comparison of Measures of Year-to-Year Variability of the Prices of Sixteen Commodities in Four Countries 191
72. Regional Differences in Monthly Variability of Tank Wagon Gasoline Prices, at Wholesale, 1919-1925 193
73. Comparison of Measures of Monthly Variability of the Prices of Four Commodities in American and British Markets 193
74. Measures of Variability of Discount Rates on Customers' Loans in Thirty Four American Cities, 1922-1926 194
75. Regional Differences in Frequency of Month-to-Month Change in Tank Wagon Gasoline Prices, at Wholesale, 1919-1925 196
76. Comparison of Measures of Frequency of Month-to-Month Change in the Wholesale Prices of Three Commodities in American and British Markets 197
77. Comparison of Trends of Farm Prices of Corn and Oats in Ten States . . 198
78. Comparison of Price Trends of Sixteen Commodities in Four Countries . 199

PAGE
TABLE
79. Regional Differences in the Sequence of Recession and Revival in Tank Wagon Gasoline Prices, at Wholesale 202
80. Regional Differences in Cyclical Movements of Tank Wagon Gasoline Prices, at Wholesale. (Measures Relating to Three Cyclical Phases) . 203
81. Regional Differences in Cyclical Movements of Tank Wagon Gasoline Prices, at Wholesale. (Duration and Percentage of Fall, 1920-1924) . 205
82. Cyclical Movements of Tank Wagon Gasoline Prices, at Wholesale, 1920-1924 206
83. Comparison of Gasoline and Portland Cement Prices in American Cities, in Respect to Regional Differences in Cyclical Movements 207
84. Measures Defining the Relations between December Farm Prices of Hay and Yield per Acre, in Six States 209
85. Percentage Distributions of Weights among Commodity Groups, United States Bureau of Labor Statistics Classification 222
86. Percentage Distributions of Weights among Commodity Groups, Federal Reserve Board Classification 222
87. Distributions of Commodities, by Groups United States Bureau of Labor Statistics Classification 223
88. Distributions of Commodities, by Groups, Federal Reserve Board Classification 223
89. Index Numbers Measuring Changes in the Level of Wholesale Prices in the United States, 1891-1902. Measures Computed from Fixed Base Relatives 231
90. Index Numbers Measuring Changes in the Level of Wholesale Prices in the United States, 1891-1902. Measures Computed fromLink Relatives. 232
91. Index Numbers Measuring Changes in the Level of Wholesale Prices in the United States, 1902-1913. Measures Computed from Fixed Base Relatives . . . .
92. Index Numbers Measuring Changes in the Level of Wholesale Prices in the 233
United States, 1902-1913. Measures Computed from Link Relatives . 234
93. Index Numbers Measuring Changes in the Level of Wholesale Prices in the United States, 1913-1926. Measures Computed from Fixed Base Relatives 235
94. Index Numbers Measuring Changes in the Level of Wholesale Prices in the United States, 1913-1926. Measures Computed from Link Relatives . 236
95. Measures Indicating the Sampling Reliability of Various Index Numbers, by Years 242
96. Average Standard Errors of Various Index Numbers 244
97. Comparison of Turning Points, United States Bureau of Labor Statistics Index (1913 = 100) and Twelve-Month Link Index 250
98. Dispersion of Wholesale Prices in the United States, 1891-1926 . . . 259
99. Standard Errors of Standard Deviations Computed from Price Relatives . 261
100. Indexes of Prices and of Price Dispersion, 1891-1926. Unweighted Geometric Averages and Indexes of Dispersion Computed from Relatives on the 1891 Base 266
101. Comparison of Indexes of Dispersion Derived from Individual Price Relatives and from Sub-Group Index Numbers of the United States Bureau of Labor Statistics 270

TABLE PAGE
102. Indexes of Dispersion Computed from Monthly Link Relatives of Commodity Prices, 1906-08, 1920-26 271
103. Geometric Means and Measures of Dispersion Computed from Twelve-Month Link Relatives of Commodity Prices, 1920-1927 276
104. Measures of Price Displacement, 1892-1926. Displacement of Fixed Base Relatives, by Periods, with Reference to a Constant Criterion in Each Period 290
105. Measures of Price Displacement, 1914-1926. Displacement of Relatives on the 1891 Base, with Reference to the Ranking of these Relatives in 1914 . 294
106. Measures of Price Displacement, 1915-1926. Displacement of Relatives on the 1909 Base, with Reference to the Ranking of Averages of these Relatives during the Years 1911-1914 297
107. Measures of Price Displacement, 1892-1926. Displacement of Fixed Base Relatives from Year to Year 299
108. Measures of Price Displacement, 1892-1926. Displacement of Two-Year Link Relatives, with Reference to the Ranking of Link Relatives in the Preceding Year 302
109. Monthly Measures of Price Displacement, 1920-1926. Displacement of Fixed Base Relatives, with Reference to Preceding Month as Criterion . 306
110. Monthly Measures of Price Displacement, 1920-1926. Displacement of Fixed Base Relatives, with Reference to Twelfth Month Preceding as Criterion 308
111. Comparison of Distributions of Logarithms of Price Relatives and Distributions of Price Relatives in Natural Form 325
112. Comparison of Weighted and Unweighted Distributions of Price Relatives . 329
113. Comparison of Distributions Constructed from Fixed Base and Link Relatives of Commodity Prices, for the Period 1914-1926 331
114. Relations between Changes in the Price Level and Other Group Movements of Prices 356
115. Relations between Changes in the Price Level (without sign) and Other Group Movements of Prices 357
116. Relations between Price Dispersion and Other Group Movements of Prices. 358
117. Relations between Price Displacement and Other Group Movements of Prices 358
118. Relations among Monthly Measures of the Group Movements of Prices . 359
119. Frequency Tables Showing Distributions of Commodity Price Series Classified according to Monthly Variability 371
120. Monthly Variability of Wholesale Prices. Averages and Standard Deviations Computed from Measures of Price Variability for Individual Commodities, 1890-1926, with Variability Measures Relating to an Index of Wholesale Prices 373
121. Frequency Table Showing the Distribution of 216 Commodity Price Series Classified according to Year-to-Year Variability during the Period 1890-1913 377
122. Frequency Tables Showing Distributions of 206 Commodities Classified according to Frequency of Monthly Price Changes 379
123. Frequency of Monthly Price Changes. Averages and Measures of Variation, by Periods 380

TABLE PAGE
124. Frequency Table Showing the Distribution of 223 Commodities Classified according to Average Annual Rate of Change in Price between 1896 and 1913 382
125. Statistical Constants Relating to Distributions of Measures of Price Variability and Trend 384
126. Percentage Classifications of 209 Commodity Price Series, Showing their Behavior during Each of Ten Business Cycles 387
127. Classifications of 209 Commodity Price Series, Showing their Behavior during Each of Eleven Periods of Revival 391
128. Classifications of 209 Commodity Price Series, Showing their Behavior during Each of Ten Periods of Recession 393
129. The Timing of Price Revival and Price Recession. Frequency Tables Showing Distributions of 1110 Observations on 149 Commodity Price Series during Ten Cycles 396
130. The Timing of Price Revival. Averages and Measures of Variation for Eleven Periods of Revival 398
131. The Timing of Price Recession. Averages and Measures of Variation for Ten Periods of Recession 402
132. Frequency Tables Showing Distributions of a Selected List of Commodities Classified according to Dates of Recession and Revival during a Post-War Business Cycle 404
133. Duration of Cyclical Price Movements. Frequency Tables Showing Distributions of 1110 Observations on 149 Commodity Price Series during Ten Cycles 406
134. Duration of Periods of Price Rise during Revival and Prosperity. Averages and Measures of Variation Derived from Observations on Individual Commodities, with Measures Relating to an Index of Wholesale Prices . 409
135. Duration of Periods of Price Fall during Recession and Depression. Averages and Measures of Variation Derived from Observations on Individual Commodities, with Measures Relating to an Index of Wholesale Prices . 412
136. Degree of Price Increase during Revival and Prosperity. Frequency Table Showing the Distribution of 1110 Observations on 149 Commodity Price Series during Ten Periods of Revival and Prosperity. 414
137. Degree of Price Rise during Revival and Prosperity. Averages and Measures of Variation Derived from Observations on Individual Commodities, with Measures Relating to an Index of Wholesale Prices . . . 416
138. Degree of Price Fall during Recession and Depression. Frequency Table Showing the Distribution of 1118 Observations on 149 Commodity Price Series during Ten Periods of Recession and Depression 418
139. Degree of Price Decline during Recession and Depression. Averages and Measures of Variation Derived from Observations on Individual Commodities, with Measures Relating to an Index of Wholesale Prices . . 421
140. Duration of Cycles in Commodity Prices. Frequency Table Showing the Distribution of 1110 Observations on 149 Commodity Price Series during Ten Business Cycles 422
141. Duration of Cycles in Commodity Prices. Averages and Measures of Variation Derived from Observations on Individual Commodities, with Measures Relating to an Index of Wholesale Prices 424

TABLE PAGE
142. Amplitude of Cycles in Commodity Prices. Frequency Table Showing the Distribution of 1110 Observations on 149 Commodity Price Series during Ten Business Cycles 427
143. Amplitude of Cycles in Commodity Prices. Averages and Measures of Variation Derived from Observations on Individual Commodities, with Measures Relating to an Index of Wholesale Prices 429
144. Statistical Constants Relating to Distributions of Measures of Cyclical Price Behavior 432

APPENDIX TABLES

I Descriptions of Wholesale Price Quotations 443
II Measures of Monthly Variability of Commodity Prices at Wholesale, by Years, 1890-1926
A. Farm Products 485
B. Minerals and Mineral Products 486
C. Fabricated Goods 487
III Measures of Monthly Variability of Six General Economic Series, by Years, 1890-1926 488
IV Measures of Monthly Variability of Commodity Prices at Wholesale, 1890-1925. Calendar Year Measures. Averages, by Periods . . 489
V Measures of Monthly Variability of Commodity Prices at Wholesale, 1890-1925. Crop Year Measures. Averages, by Periods . . . 494
VI Measures of Monthly Variability of the Prices of Farm Products and Foods, at Wholesale. Averages, 1890-1925 (excluding 1914-1921) . 495
VII Measures of Year-to-Year Variability of Commodity Prices at Wholesale 497
VIII Measures of Price Variability. Indexes of Frequency of Change in Monthly Commodity Prices, at Wholesale, 1890-1925, by Periods . 502
IX Average Annual Rates of Change in Prices and Purchasing Power of Commodities, at Wholesale, 1896-1913 507
X Measures Describing the Behavior of Wholesale Commodity Prices during Periods of Revival and Recession in American Business, 1890-1925. Timing of Cyclical Movements in Individual Commodity Prices at Twenty One Turning Points in General Prices . . . 512
XI Measures Describing Cyclical Movements in the Wholesale Prices of Twenty Four Representative Commodities, 1890-1925 519
XII Averages Relating to Timing, Duration and Amplitude of Cyclical Movements in the Wholesale Prices of Individual Commodities, 1890-1925 528
XIII Ranking of Commodities by Groups according to the Average Duration of Price Cycles 543
XIV Ranking of Commodities by Groups according to the Average Amplitude of Cyclical Price Movements 548
XV Average Sequence of Revival in the Wholesale Prices of Commodities, by Groups, with Measures of Inconsistency 553
XVI Ranking of Commodities by Groups according to the Average Duration of the Period of Rising Prices 558

Table		Page
XVII	Average Sequence of Recession in the Wholesale Prices of Commodities, by Groups, with Measures of Inconsistency	563
XVIII	Ranking of Commodities by Groups according to the Average Duration of the Period of Falling Prices	568
XIX	Measures Descriptive of Frequency Distributions of Unweighted Fixed Base Relatives of Commodity Prices at Wholesale, in the United States, 1891-1926 (Arithmetic Measures)	573
XX	Measures Descriptive of Frequency Distributions of Weighted Fixed Base Relatives of Commodity Prices at Wholesale, in the United States, 1891-1926 (Arithmetic Measures)	575
XXI	Measures Descriptive of Frequency Distributions of Unweighted Fixed Base Relatives of Commodity Prices at Wholesale, in the United States, 1913-1926 (Geometric and Logarithmic Measures)	577
XXII	Measures Descriptive of Frequency Distributions of Weighted Fixed Base Relatives of Commodity Prices at Wholesale, in the United States, 1913-1926 (Geometric and Logarithmic Measures)	578
XXIII	Measures Descriptive of Frequency Distributions of Unweighted Link Relatives of Commodity Prices at Wholesale, in the United States, 1913-1926 (Arithmetic Measures)	579
XXIV	Measures Descriptive of Frequency Distributions of Weighted Link Relatives of Commodity Prices at Wholesale, in the United States, 1913-1926 (Arithmetic Measures)	580
XXV	Measures Descriptive of Frequency Distributions of Unweighted Link Relatives of Commodity Prices at Wholesale, in the United States, 1891-1926 (Geometric and Logarithmic Measures)	581
XXVI	Measures Descriptive of Frequency Distributions of Weighted Link Relatives of Commodity Prices at Wholesale, in the United States, 1891-1926 (Geometric and Logarithmic Measures)	583
XXVII	Measures Descriptive of Frequency Distributions of Unweighted Fixed Base Relatives of Commodity Prices at Wholesale, in the United States, 1903-1926 (Arithmetic Measures), 1891 = 100	585

LIST OF CHARTS

FIGURE PAGE

1. Variability of Commodity Prices, at Wholesale. Measures of Monthly Variability Expressed as Percentages of Average Annual Prices, 1890-1926
   - A. Farm Products 42
   - B. Minerals and Mineral Products 42
   - C. Fabricated Goods 43
2. Measures of Monthly Variability of Four General Economic Series, Expressed as Percentages of Average Annual Values, 1890-1926 . . . 43
3. Variability of Commodity Prices, at Wholesale. Ranking of Commodities by Groups according to the Monthly Variability of Prices 47
4. Frequency of Change in Commodity Prices, at Wholesale. Ranking of Commodities by Groups according to the Frequency of Month-to-Month Price Changes 59
5. Relative Prices of Four Commodities, at Wholesale, 1896-1913, with Lines of Trend 65
6. Illustrating the Diversity of Trends in Wholesale Commodity Prices. Lines of Trend Measuring the Average Annual Rates of Change in Individual Commodity Prices between 1895 and 1913 68
7. Average Annual Rates of Change in Commodity Prices, at Wholesale. Ranking of Commodities by Groups according to the Average Annual Rates of Change in their Wholesale Prices during the Period 1896-1913 . 70
8. Diagram Showing the Relation between the Wholesale Prices of Tame Hay and the Total Production of Tame Hay in the United States . . . 147
9. Diagram Showing the Relation between the Wholesale Prices of Potatoes in Chicago and the Per Capita Consumption of Potatoes in the United States 150
10. Average Monthly Prices and Measures of Regional Differences in the Prices of Portland Cement, at Wholesale, in Ten American Cities, 1919-1924 . 165
11. Average Monthly Prices and Measures of Regional Differences in the Prices of Tank Wagon Gasoline, at Wholesale, in Ten American Cities, 1919-1927 171
12. Absolute Measures of Regional Differences in the Farm Prices of Six Agricultural Products. Averages, by Periods 177
13. Farm Prices of Six Agricultural Products. Average Price per Bushel, by Periods 177
14. Relative Measures of Regional Differences in the Farm Prices of Seven Agricultural Products. Averages, by Periods 178
15. Average Discount Rate on Customers' Loans in Twenty Six to Thirty Five Cities, Index of Regional Differences in Customers' Rates, and Rate on 60-90 Day Paper in New York, July, 1918-June, 1927 183
16. Link Relatives of the Average Farm Prices of Corn in Ten Important Producing States, 1889-1926 187
17. Diagram Showing Regional Differences in the Degree of Change in Cost of Living in the United States between 1914 and 1927 188

Figure — Page

18. International Differences in the Variability of Wholesale Prices, 1890-1913. Comparison of Four Commodities in Four Countries in Respect to Year-to-Year Variability 190
19. Discount Rates in American Cities. Customers' Rates and Measures of Variability of Customers' Rates in Thirty Four Cities 195
20. International Differences in Commodity Price Trends. Comparison of Four Commodities in Four Countries in Respect to Average Annual Rates of Change in Wholesale Prices from 1896 to 1913 200
21. Column Diagrams Showing Frequency Distributions of Price Relatives, 1914-1926 224
22. Index Numbers of Wholesale Prices, 1913-1926. United States Bureau of Labor Statistics Index Number and Six Index Numbers Computed from Fixed Base Relatives (1913 = 100) 237
23. Index Numbers of Wholesale Prices, 1913-1926. Six Index Numbers Constructed by Chaining Averages of Link Relatives (1913 = 100) 237
24. Fluctuations in Wholesale Prices, by Months, 1900-1927. Comparison of a Fixed Base Index and a Twelve-Month Link Index 249
25. An Illustration of Price Dispersion: Relative Prices of Ten Minerals, with their Geometric Mean, 1913-1926 (1913 = 100) 253
26. An Illustration of Price Dispersion: Link Relatives of Ten Minerals, with their Geometric Mean, 1913-1926 253
27. Dispersion of Related Price Series. Relative Prices of Cattle, Hides, Leather and Shoes, 1913-1926 (1913 = 100) 255
28. Index Numbers Measuring Changes in the Level of Wholesale Prices and in Price Dispersion, 1892-1926. Weighted Geometric Means and Indexes of Dispersion Computed from Fixed Base Relatives for the Periods 1891-1902, 1902-1913, 1913-1926 263
29. Comparison of Indexes of Price Dispersion Computed from Fixed Base Relatives for the Periods 1891-1902, 1902-1913, 1913-1926 264
30. Index Numbers Measuring Changes in the Level of Wholesale Prices and in Price Dispersion, 1891-1926. Unweighted Geometric Means and Indexes of Dispersion Computed from Fixed Base Relatives 267
31. Index Numbers Measuring Changes in the Level of Wholesale Prices and in Price Dispersion, 1891-1926. Weighted Geometric Means and Indexes of Dispersion Computed from Annual Link Relatives 268
32. Monthly Index Numbers of Wholesale Prices and of Price Dispersion, 1906-1908 272
33. Monthly Index Numbers of Wholesale Prices and of Price Dispersion, 1920-1926 274
34. Monthly Index Numbers of Wholesale Prices and of Price Dispersion, 1920-1926. Weighted Geometric Means and Indexes of Dispersion Computed from Twelve-Month Link Relatives of 100 Commodities 277
35. Measures of Dispersion Computed from Fixed Base Relatives, by Periods, 1892-1926 281
36. An Illustration of Price Displacement. Changes in the Relative Prices of Four Commodities from 1913 to 1916 287

FIGURE PAGE
37. Indexes of Price Displacement, 1893-1926. Measures of the Degree of Shifting of Fixed Base Relatives, by Periods, with Reference to a Constant Criterion and to Chain Criteria in Each Period 291
38. Indexes of Price Displacement, 1915-1926. Measures of the Degree of Shifting of Three Series of Fixed Base Relatives, with Reference to a Constant Criterion for Each Series 295
39. Indexes of Price Displacement, 1893-1926. Measures of the Degree of Shifting of Two-Year Link Relatives, with Reference to the Ranking of Link Relatives in the Preceding Year 303
40. Monthly Indexes of Price Displacement, 1920-1926. Measures of the Degree of Shifting of Fixed Base Relatives, with Reference to Preceding Month as Criterion 307
41. Monthly Indexes of Price Displacement, 1920-1926. Measures of the Degree of Shifting of Fixed Base Relatives, with Reference to Twelfth Month Preceding as Criterion 309
42. Population Types. Diagram Showing the Location of Points Representing Various Types of Distributions 316
43. The Population of Prices. Diagram Showing the Location of Points Representing Distributions of Unweighted Fixed Base Relatives in Natural Form, 1892-1926 341
44. Measures of Skewness of Distributions of Unweighted Fixed Base Relatives in Natural Form, 1892-1926 342
45. Measures of Kurtosis of Distributions of Unweighted Fixed Base Relatives in Natural Form, 1892-1926 343
46. Values of the Criterion κ_1 for Distributions of Unweighted Fixed Base Relatives in Natural Form, 1892-1926 344
47. The Movement toward Price Equilibrium, 1916-1923. Diagram Showing the Location of Points Representing Distributions of Unweighted Fixed Base Relatives in Natural Form 346
48. The Population of Prices. Diagram Showing the Location of Points Representing Distributions of Weighted Link Relatives in Logarithmic Form, 1891-1926 349
49. Measures of Skewness of Distributions of Weighted Logarithms of Link Relatives, 1891-1926 350
50. Measures of Kurtosis of Distributions of Weighted Logarithms of Link Relatives, 1891-1926 351
51. Values of the Criterion κ_1 for Distributions of Weighted Logarithms of Link Relatives, 1891-1926 352
52. Column Diagrams Showing Distributions of Measures of Monthly Variability for Selected Years, with a Distribution Based upon Averages for the Period 1890-1925 372
53. Measures of Monthly Variability of Wholesale Prices. Comparison of Annual Averages, Computed from Measures of Variability of Individual Price Series, with Measures Derived from the Index of Wholesale Prices of the United States Bureau of Labor Statistics 375
54. Column Diagram Showing the Distribution of Measures of Year-to-Year Variability Based upon Prices of 216 Commodities during the Period 1890-1913 378

FIGURE PAGE
55. Column Diagrams Showing Distributions of Measures of Frequency of Price Change, by Periods 381
56. Column Diagram Showing the Distribution of Measures Defining the Average Annual Rates of Change in the Prices of 223 Commodities during the Period 1896-1913 383
57. The Population of Prices. Diagram Showing the Location of Points Defined by the Values of β_1 and β_2 for Distributions of Measures Describing the Behavior of Commodity Prices 385
58. The Behavior of Commodity Prices during Business Cycles. Percentage Distributions of 209 Commodities Classified according to Behavior during Ten Business Cycles 388
59. The Behavior of Commodity Prices during Revival. Percentage Distributions of 209 Commodities Classified according to Behavior during Eleven Periods of Revival 392
60. The Behavior of Commodity Prices during Recession. Percentage Distributions of 209 Commodities Classified according to Behavior during Ten Periods of Recession 394
61. The Timing of Price Revival. Column Diagram Showing the Distribution of 1110 Observations on Individual Commodity Price Series . . . 397
62. The Timing of Price Revival. Column Diagrams of Distributions Relating to Eleven Periods of Revival 399
63. The Timing of Price Recession. Column Diagram Showing the Distribution of 1110 Observations on Individual Commodity Price Series . . 400
64. The Timing of Price Recession. Column Diagrams of Distributions Relating to Ten Periods of Recession 401
65. The Timing of Price Revival and Price Recession. Column Diagrams Showing Distributions of Wholesale Price Series Classified according to the Date of Recession (1919-1921) and the Date of Revival (1921-1923) . . 405
66. The Duration of Price Rise during Revival and Prosperity. Column Diagram Showing the Distribution of 1110 Observations on Individual Commodity Price Series 407
67. The Duration of Price Rise during Revival and Prosperity. Column Diagrams of Distributions Relating to Ten Periods of Revival and Prosperity . 408
68. Averages Measuring the Duration of Periods of Price Revival and Price Recession during Ten Cycles 410
69. The Duration of Price Fall during Recession and Depression. Column Diagram Showing the Distribution of 1110 Observations on Individual Commodity Price Series 411
70. The Duration of Price Fall during Recession and Depression. Column Diagrams Relating to Ten Periods of Recession and Depression . . . 413
71. The Degree of Price Rise during Revival and Prosperity. Column Diagram Showing the Distribution of 1110 Observations on Individual Commodity Price Series 415
72. The Degree of Price Rise during Revival and Prosperity. Column Diagrams of Distributions Relating to Ten Periods of Revival and Prosperity . . 416
73. Averages Measuring the Degree of Price Rise and Price Decline during Ten Cycles 417

Figure Page
74. The Degree of Price Decline during Recession and Depression. Column Diagram Showing the Distribution of 1118 Observations on Individual Commodity Price Series 419
75 The Degree of Price Decline during Recession and Depression. Column Diagrams Relating to Ten Periods of Recession and Depression . . . 420
76. Duration of Cycles in Commodity Prices. Column Diagram Showing the Distribution of 1110 Observations on Individual Commodity Price Series . 423
77. Duration of Cycles in Commodity Prices. Column Diagrams of Distributions Relating to Ten Business Cycles 424
78. Duration of Cycles in Commodity Prices. Comparison of Averages Computed from Individual Observations with Measures Derived from the Index of Wholesale Prices of the United States Bureau of Labor Statistics . 425
79. Amplitude of Cycles in Commodity Prices. Column Diagram Showing the Distribution of 1110 Observations on Individual Commodity Price Series . 428
80. Amplitude of Cycles in Commodity Prices. Column Diagrams of Distributions Relating to Ten Business Cycles 429
81. Amplitude of Cycles in Commodity Prices. Comparison of Averages Computed from Individual Observations with Measures Derived from the Index of Wholesale Prices of the United States Bureau of Labor Statistics . 430

THE BEHAVIOR OF PRICES

By

FREDERICK C. MILLS

INTRODUCTION

That prices play a part of extreme importance in the working of the economic system requires no demonstration. The production, distribution and consumption of goods are, of course, fundamental activities, but as the modern economic system is organized they are conditioned and influenced at every point by prices and price relations. Prices constitute the medium of economic control. It is futile to study modern economic life without regard to the part which money and prices play.

This part has been described in a general way elsewhere, and calls for no extended treatment here. The prices of individual commodities, in their changes, stimulate or retard production and consumption and, in turn, reflect changes in production and consumption. So, also, the prices of individual services affect, and reflect, changes in the direction of human effort. But there exists a broader set of price relations, of importance equal to the specific connections between changes in the prices and quantities of individual commodities. These are the numerous relations, of varying degrees of intimacy, which tie all prices into a system—"a highly complex system of many parts connected with each other in diverse ways, a system infinitely flexible in detail yet stable in the essential balance of its interrelations, a system like a living organism in its ability to recover from the serious disorders into which it periodically falls."[1]

The objectives of the present study are, first, to secure a fuller understanding of the behavior of individual commodity prices and, secondly, to increase our knowledge of the working of the price system and of the interrelations between its component elements. To attain the first objective we shall make use of various methods of measuring the characteristics of individual price series. In seeking to attain the second we shall be searching for uniformities and regularities in the behavior of prices in combination. We shall be measuring tendencies which manifest themselves when a group of prices is studied, and tracing relations between prices and groups of prices. We shall be seeking principles of order in the realm of prices.

---

[1] *Business Cycles*, by Wesley C. Mitchell. Berkeley, University of California Press, 1913, p. 31.

This search for uniformities and regularities is that which engages scientific workers in all fields. It is a simple undertaking—before the data are collected and one immerses himself in masses of facts. Then there emerge those "profundities, complexities, involutions, analogies, differences and dependencies" which both harass and encourage the research worker. In all work in the biological and social sciences these complexities are intensified by the omnipresent fact of variation, a reflection of the presence of numerous forces behind the phenomena we are observing.

Yet, in spite of the number of factors and the complexity of the facts, there is hope of finding regularities in the field to be studied. It was one of the most fruitful scientific discoveries of modern times that regularities appear even where sheer chance rules. Though in the realm of chance the individual event may be unpredictable, definite principles of order prevail among groups of such events. When we are dealing with the price system it is with groups of observations that we shall be concerned, and when we seek for regularities it will be regularities among large groups, to which individual prices may furnish numerous exceptions.

The reason for the existence of regularities in the price system, as in all fields marked by the presence of such variation and complexity as here prevail, may not be a matter of immediate economic interest. Yet a suggestion of Charles S. Peirce is so pertinent to the study of prices that it may be touched upon. Peirce found the explanation of regularities in the universe in a tendency to form habits, a tendency toward mutual assimilation, which he believed to prevail in nature.[1] The validity of this hypothesis, as applied to all nature, does not concern us here. But the price system seems to furnish a striking and curious illustration of such a tendency in the realm of economics, a tendency of which there is, perhaps, a rational explanation which cannot be found for Peirce's broader generalization.

The isolated prices that were quoted in the dawn of the money economy must have been connected to other prices by ties that were but feeble and remote, and the circle within which the influence of a given price transaction was felt must have been a very narrow one.[2] But as the money economy developed these ties increased in number and in strength. Small net-works of price relations expanded and established contacts with other such net-works. The price system grew until the mesh of price relations included, as it does today, all industrialized communities. While this "mutual assimilation" was taking place, those regularities which, in Peirce's view, constitute the "habits" of nature were coming into existence. Characteristic modes of behavior were being impressed upon various groups of prices by underlying natural forces, by the pressure of competition, by factors connected with the business cycle, and by other agencies the effects of which probably cannot be traced in detail. And the process by which price ties have been formed and by which characteristic modes of behavior have been acquired still goes on.

---

[1] *Chance, Love and Logic*, New York, Harcourt Brace, 1923.

[2] It is probable that in early historical periods price transactions were few, comments Dr. Gay, and that the ties which would create a system of prices were feeble. But the relations among such prices as existed, and the temporal ties binding given prices to those earlier and later in time, were close and rigid. The few established prices (e. g. those for cattle, slaves, salt) changed but little or not at all over long periods of time.

In some such way has the price structure developed. Out of the bids and offers of burgher, craftsman and wandering trader has grown an all-embracing system, with the "profundities, complexities, involutions, analogies, differences and dependencies" which it is the duty of the economist to trace. The pioneer work of Wesley C. Mitchell marked a beginning in the charting of this system and in the tracing of the bonds which tie together the component parts. The completion of this work lies far in the future. If the price system could be fully explored, if all ties and connections could be traced and all fluctuations explained, then, perhaps, man could understand and control the economic system he has created. We can doubtless come much closer to that objective than we now are. It is doubtful, in a changing world, that it will ever be attained.

In attacking this general problem the first step has been the securing of measures which describe the behavior of individual commodity prices. Not all the characteristics of individual prices are subject to measurement according to a standardized scheme, but such a scheme is necessary if comparable results are to be secured. The first part of the present report is concerned with the development of such measures. These measures possess interest and economic significance in their own right for the light they throw on the behavior of individual commodity prices, and for this reason the results have been given in detail. They are of interest, also, for another reason. Such measures for a number of individual price series furnish the raw materials for the study of tendencies, variations and relations of various sorts within the system of prices. This is the primary purpose for which they have been assembled. These measures are dealt with in the first two chapters of the present volume.

The third and fourth chapters are concerned with the behavior of prices in combination. The various measures discussed in these chapters relate to the price structure as a whole, without regard to its component elements. We might view the sections which relate to prices in combination as dealing with the stability and instability of prices. George Darwin has said that the study of stability and instability furnishes the main problems with which physicist and biologist are alike concerned, and it is probable that most economic problems have a similar genesis. It is certain that the main problems to be faced in an analysis of the price system are essentially problems of stability and instability. It is the instability of this system and the economic effects of this instability which render so imperative a fuller understanding of it, and make so necessary an increase in our power to control it. This necessity of understanding holds, no matter what the cause or causes of price instability may be. Whether price instability be traceable to specific money and price conditions, whether price instability be merely a reflection of general economic instability, or whether price instability and economic instability react upon each other, this subject is a matter of crucial importance.

The nature of price instability is itself a matter for investigation, before methods of measuring instability may be considered. Our primary interest here is not in the instability of prices of individual commodities, though this is involved in the problem, but in conditions of general price instability, where large numbers of commodities are concerned. But the term "price instability" in this general sense is often used ambiguously. What is meant by a condition of price instability? What kinds of instability may be present in the price structure? How shall price instability be measured? Are the currently compiled index numbers of prices adequate measures of all the disruptions and distortions which may develop within the system of prices? These are some of the questions which will receive consideration.

In a later study the materials assembled in the present volume will be used, with other data, in seeking to define certain of the component elements of the price system, and in attempting to trace relations between these elements.

Satisfactory data constitute, of course, a prime requirement in such an investigation. In the field of prices we have data which serve in a fairly satisfactory fashion for the construction of wholesale price index numbers of the usual type. But data which will serve this purpose may not be satisfactory for a detailed study of price behavior of the type here suggested. For this latter purpose we need a considerable number of pure price series drawn from various geographical regions and representing all stages of the productive and distributive process. By a *pure* price series is meant one which relates to a homogeneous commodity, which is drawn from a single market (i. e., is not an average of prices in several markets) and which is derived throughout from the same type of transaction. Having a wide variety of such series, representing all geographical areas and all economic stages, the application of a standardized technique of analysis would yield a wealth of information regarding the behavior of individual prices, the relations among elements in the price system, the incidence of the business cycle, the characteristics of a competitive price, and the price structure in general. The compilation of such data, adequate both in quality and scope, is a task for the future.

Considerable emphasis has been placed in the present study upon the technique of analysis. A few of the elements in this technique are novel; most of them are orthodox statistical devices. Their application, in combination, represents an attempt at a systematic study of price behavior. The technique is doubtless capable of improvement, but only by the extensive application of some such standard method can economists build up that body of concrete facts and principles relating to price behavior and price relations which is necessary to an understanding of the price system.

CHAPTER I

MEASURABLE CHARACTERISTICS OF COMMODITY PRICES

The present inquiry is concerned with the behavior of commodity prices, singly and in combination. Of the movements to which the prices of specific commodities are subject but little is known, in detail, and our knowledge of the immediate causes of such movements and their relative importance is still more meager. Without such detailed information an accurate conception of the structure and working of the price system is impossible. The first stage of the investigation deals, accordingly, with the behavior of individual commodity prices.

No list of the characteristics of specific price series would be complete for all purposes. In selecting the characteristics which are described in this study emphasis has been placed on those properties of commodity prices which possess general economic interest and which lend themselves to quantitative treatment. The present classification is an experimental one, however, and is not to be looked upon as rigid or exhaustive. This classification includes the following aspects of price behavior:

1. Changes between specific dates.
2. Variability.
3. Trend over a stated period of time.
4. Timing, duration and amplitude of individual price changes during general price movements.
5. Flexibility; correlation between prices and quantities.
6. Regional differences in prices and in price behavior.

A consideration of the nature of the above characteristics and the selection of suitable methods of measurement will be our first concern. Five of these characteristics are treated in the present chapter. Regional differences in prices and in price behavior, which stand in a slightly different category, are discussed in the following chapter.

I Price Changes Between Specific Dates

Changes of this type require no explanation here, for they have furnished the main problems which have engaged students of prices in the past. Attention was first drawn to the important fact of a fluctuating price level and to related questions dealing with the purchasing power of money by such changes in the prices of individual commodities, and the data for the study of these problems have been derived from records of individual price movements.

Changes in commodity prices from day to day, week to week, month to month, year to year, or in reference to a fixed base, may be measured either in absolute or relative terms. The following table furnishes examples of the measures which may be employed.

TABLE 1

Average Annual Prices of Hides, at Wholesale, 1890-1926
(Green, salted, packers': heavy native steers, Chicago)[1]

(1) Year	(2) Average price per pound	(3) Price change from preceding year	(4) Link relative (preceding year =100)	(5) Fixed base relative (1913=100)
1890	$.093			50.7
1891	.095	$+.002	101.9	51.7
1892	.087	—.008	91.6	47.3
1893	.075	—.012	86.1	40.7
1894	.064	—.011	85.6	34.9
1895	.103	+.039	160.4	55.9
1896	.081	—.022	78.9	44.1
1897	.100	+.019	122.8	54.2
1898	.115	+.015	115.6	62.6
1899	.124	+.009	107.3	67.2
1900	.119	—.005	96.7	64.9
1901	.124	+.005	103.6	67.3
1902	.134	+.010	108.2	72.8
1903	.117	—.017	87.3	63.6
1904	.117	+.000	100.0	63.4
1905	.143	+.026	122.6	77.8
1906	.154	+.011	107.9	83.9
1907	.146	—.008	94.3	79.1
1908	.134	—.012	91.8	72.6
1909	.165	+.031	123.3	89.6
1910	.155	—.010	93.9	84.1
1911	.148	—.007	95.5	80.3
1912	.176	+.028	119.2	95.7
1913	.184	+.008	104.5	100.0
1914	.196	+.012	106.7	106.7
1915	.242	+.046	123.3	131.6
1916	.262	+.020	108.2	142.4
1917	.327	+.065	124.8	178.0
1918	.301	—.026	92.0	163.8
1919	.393	+.092	130.6	213.8
1920	.312	—.081	79.4	169.8
1921	.139	—.173	44.6	75.6
1922	.180	+.041	129.5	98.0
1923	.167	—.013	92.8	90.6
1924	.147	—.020	88.0	79.9
1925	.160	+.013	108.8	87.1
1926	.140	—.020	87.6	76.3

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[1] Except where otherwise noted all prices are taken from the wholesale price bulletins of the U. S. Bureau of Labor Statistics.

In a later chapter the analysis of such measures, in combination, is discussed in detail.

II Variability of Commodity Prices

Commodities differ materially among themselves in respect to the amplitude and frequency of their price movements, their "proper fluctuations," in Edgeworth's phrase. The prices of certain commodities, such as bread, change but slightly or not at all over a long period of time. Others, of which potatoes are a notable example, are characterized by widely varying prices from month to month and from year to year. These differences in variability may be due to differences in the organic nature of the commodities in question, or to differences in the conditions under which they are produced, marketed and consumed.

The type of variability which is to be measured is a matter for determination before methods of measurement may be decided upon. For some purposes interest might attach to day-to-day, week-to-week, month-to-month or year-to-year variation, or to seasonal or cyclical price fluctuations. Cyclical movements are dealt with in section IV, below. No attempt has been made in this study to measure seasonal movements. It has not seemed feasible or desirable, for the purposes of the present inquiry, to compute measures of variability relating to such short intervals as the day or the week. These considerations restrict us in the present section to three indexes of price variability, one measuring the amplitude of monthly price fluctuations, another measuring the frequency of monthly price changes, a third measuring the amplitude of year-to-year movements.

1. The Measurement of Monthly Variability

In measuring the fluctuations of monthly prices within a given year, the mean deviation from the average price for the year has been employed. This measure may be exemplified with reference to the following price quotations.

TABLE 2

Average Monthly Prices of Print Cloths, at Wholesale, 1925
(27 inch, 64 x 60)

Month	Average price per yard	Month	Average price per yard
January	$.069	July	.065
February	.068	August	.066
March	.069	September	.067
April	.067	October	.067
May	.064	November	.063
June	.063	December	.061
			Average .066

The average deviation of these twelve monthly prices from their mean is \$.00208. Expressing this measure as a percentage of the mean, for purposes of comparison, we have a value of 3.2. Such measures have been computed for print cloths for the years from 1890 to 1926. These appear in Table 3 and, in graphic form, in Figure 1-C.

TABLE 3

MEASURES OF MONTHLY VARIABILITY OF PRINT CLOTH PRICES, 1890-1926

Year	Mean deviation as percentage of mean annual price	Year	Mean deviation as percentage of mean annual price
1890	2.6	1909	5.7
1891	1.6	1910	4.8
1892	7.2	1911	5.4
1893	12.5	1912	6.5
1894	2.7	1913	3.6
1895	7.5	1914	9.9
1896	3.5	1915	6.4
1897	3.5	1916	14.4
1898	4.0	1917	14.5
1899	4.3	1918	8.1
1900	5.9	1919	20.9
1901	7.4	1920	26.7
1902	4.4	1921	14.2
1903	2.2	1922	7.8
1904	10.9	1923	6.8
1905	13.0	1924	3.1
1906	4.4	1925	3.2
1907	7.4	1926	6.1
1908	6.8		

Measures of variability similar to the above have been computed for over two hundred commodities for each year from 1890 to 1926, employing wholesale price quotations. (The actual number varies from 204 to 214.) Each annual measure relates to price variation within the year, reflecting movements due to all causes, secular, seasonal, cyclical, or accidental. For some purposes it would be desirable to segregate these elements and to have measures of the price variation due to each of these forces acting in isolation. Partly because of the physical impossibility of analyzing in this refined fashion any large number of cases, no attempt has been made to separate these elements in measuring variability.[1] But there were other considerations in the choice of the present method. For many practical purposes the deviations of prices within a given year

[1] See, however, the measures relating to trends and to cyclical movements which are given in sections III and IV of this chapter.

from the average for that year need not be broken up and attributed to diverse forces. The price changes themselves are the facts of immediate concern to producers and consumers. A measure of these variations in the price of a single commodity may be accepted at its face value and compared with similar measures for other commodities.

If there is an appreciable upward or downward trend in the prices of a given commodity, or if these prices are subject to considerable changes from year to year for any reason, the absolute mean deviations for different years would not be comparable, since the bases from which the deviations are measured would differ materially in value. This difficulty is overcome by expressing the mean deviations as percentages of the respective annual averages. Thus, although the trend factor may slightly affect the value of the measure of variability for a given year, it does not lessen the comparability of measures for different years.

For most agricultural products more significance attaches to measures of price variability based upon monthly prices prevailing within the crop year than to measures derived from prices within the calendar year. The use of the calendar year introduces changing crop conditions as one important element in monthly variability. By restricting the annual measures to crop years we secure a time unit within which the influence of one crop is dominant. Such measures have been computed for 18 agricultural products, to which there correspond 19 price series.[1]

It is impossible to include in this report all the measures of

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[1] Following are the commodities for which crop year measures have been computed. The crop years employed are indicated.

Commodity	Crop Year
Barley	August to July
Corn	November to October
Oats	August to July
Rye	July to June
Wheat	July to June
Beans	September to August
Cotton	August to July
Eggs	April to March
Flaxseed	September to August
Hay	July to June
Hops	July to June
Onions	July to June
Potatoes	September to May
Rice	August to July
Flour, rye	July to June
Flour, wheat	July to June
Apples (evaporated)	June to May
Cottonseed oil	August to July

FIGURE 1

VARIABILITY OF COMMODITY PRICES, AT WHOLESALE.

Measures of Monthly Variability, expressed as Percentages of Average Annual Prices, 1890-1926.

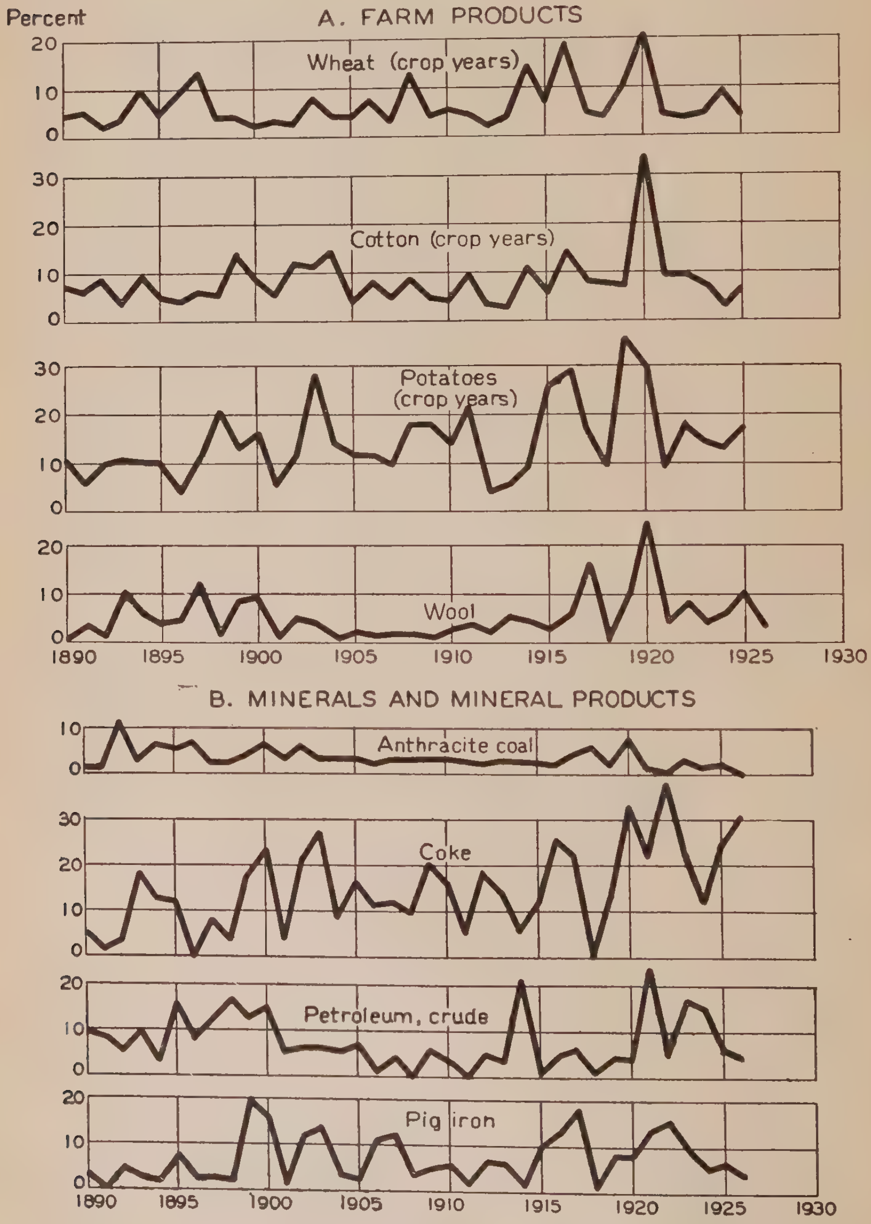


FIGURE 1 (Cont.)

VARIABILITY OF COMMODITY PRICES, AT WHOLESALE.

Measures of Monthly Variability, expressed as Percentages of Average Annual Prices, 1890-1926.

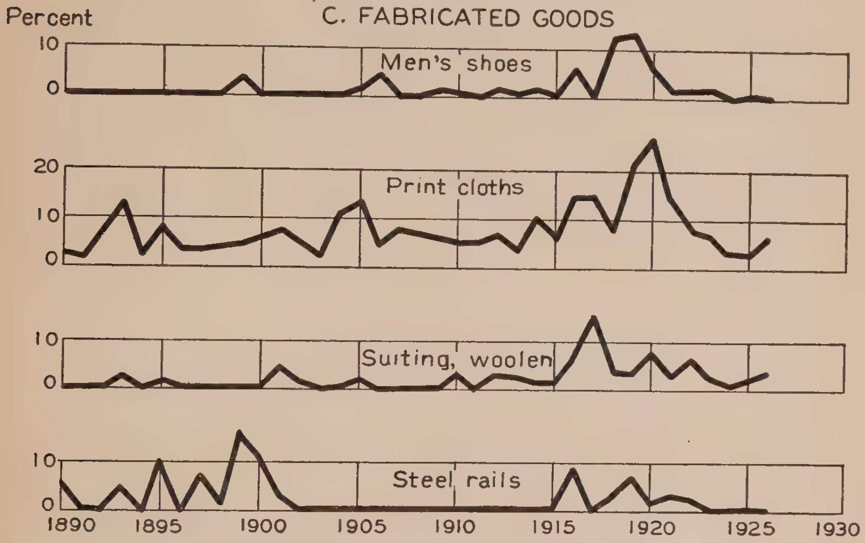
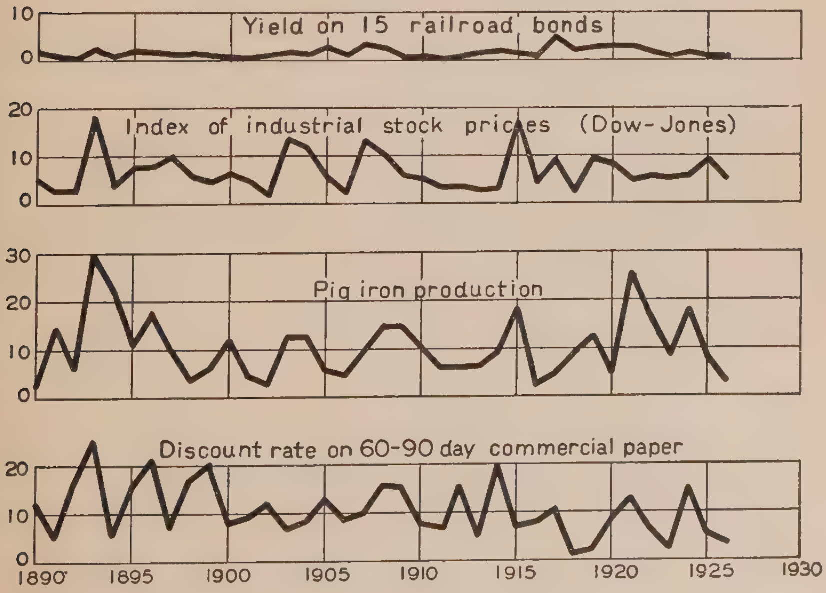


FIGURE 2

Measures of Monthly Variability of Four General Economic Series, expressed as Percentages of Average Annual Values 1890-1926.



variability computed for the separate years since 1890 for all the commodities studied. In Table II[1] annual measures for the years from 1890 to 1926 are given for three selected groups of commodities, representing agricultural products, raw minerals and metals, and fabricated industrial products. The measures for certain of these commodities are presented graphically in Figure 1. There are, it will be noted, pronounced differences between these commodities in respect to the magnitude of monthly price fluctuations and in the changes which have taken place in these movements during the period covered.

For comparison with these indexes of price variability corresponding measures have been computed for a number of other economic series. The annual values are given in Table III, of the Appendix. Four of these series are plotted in Figure 2.

The measures of monthly price variability for all commodities are shown, in summary form, in Tables IV and V. In order that changes in variability may be noted, the period from 1890 to 1925 has been divided into five subdivisions, including four periods of eight years each and a final period of four years, and a measure of variability has been computed for each of these periods. In addition, two general averages have been calculated. One of these is based upon the entire 36 years covered, the other upon the same data excluding the disturbed years, 1914 to 1921.[2]

The following figures, relating to the prices of nineteen important commodities, exemplify the results secured. These commodities are arranged in order of magnitude of the averages in column (9).

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[1] Roman numerals refer to tables in the Appendix, while Arabic numbers refer to tables in the body of the text.

[2] The averages based upon crop-years cover only 35 years. The sub-periods are of the same length as those relating to calendar year measures, except for the second period, from 1898-99 to 1904-05, which includes but 7 years.

TABLE 4
MEASURES OF MONTHLY VARIABILITY OF PRICES OF SELECTED COMMODITIES, AT WHOLESALE, 1890-1925
Averages, by Periods

(1) Ref. No.[1]	(2) Commodity	(3) 1890–1897	(4) 1898–1905	(5) 1906–1913	(6) 1914–1921	(7) 1922–1925	(8) 1890–1925 inclusive	(9) 1890–1925 excluding 1914–21
280	Steel rails	3.4	3.9	0.0	3.1	.6	2.4	2.2
441	Leather	3.2	2.8	1.8	4.7	3.9	3.2	2.8
233	Anthracite coal	4.9	4.1	3.0	3.7	1.8	3.7	3.7
120	Flour, wheat[2]	4.5	3.4	4.8	9.9	5.2	5.7	4.4
293	Copper, ingot	5.3	3.7	6.1	8.3	4.1	5.7	4.9
64	Beef	5.4	4.2	5.4	5.8	4.9	5.2	5.0
236	Bituminous coal	5.7	5.4	2.1	9.4	9.2	6.0	5.0
202	Cotton yarns[3]	4.3	6.1	5.1	13.7	5.9	7.4	5.4
6	Wheat[2]	6.8	4.2	5.5	10.3	5.4	6.6	5.5
13	Cattle	4.9	4.3	6.0	7.0	8.4	5.9	5.6
195	Print cloths	5.1	6.5	5.6	14.4	5.2	7.6	5.7
259	Pig iron	3.1	8.6	6.5	9.3	11.9	7.1	6.5
149	Sugar, raw	8.5	5.1	6.8	12.4	9.2	8.3	7.1
276	Steel billets	6.6	9.8	5.9	9.6	5.4	7.7	7.2
25	Cotton[2]	6.5	10.1	5.7	11.3	7.3	8.2	7.3
247	Petroleum	9.0	9.4	2.9	8.1	10.5	7.7	7.6
451	Rubber	5.2	3.9	10.9	10.1	17.7	8.7	8.2
51	Potatoes[2]	9.0	15.5	13.6	20.0	13.5	14.4	12.7
239	Coke	7.7	15.3	13.3	16.8	24.4	14.5	13.9

[1] A reference number has been given to each wholesale price series used. A complete list, with descriptions, is contained in Table I, of the Appendix.

[2] Averages are for crop years 1890-91 to 1897-98, 1898-99 to 1904-05, 1905-06 to 1912-13, etc.

[3] Prices for 1890, 1891, 1892 missing.

Similar averages for certain selected economic series are given below.

TABLE 5
MEASURES OF MONTHLY VARIABILITY OF SIX ECONOMIC SERIES, 1890-1925
Averages, by Periods

(1)	(2) 1890–1897	(3) 1898–1905	(4) 1906–1913	(5) 1914–1921	(6) 1922–1925	(7) 1890–1925 inclusive	(8) 1890–1925 excluding 1914–1921
Yield on fifteen railroad bonds	1.4	1.3	1.4	2.5	1.3	1.6	1.4
Index of general business conditions (A. T. & T.)	5.3	2.7	2.8	4.3	4.8	3.9	3.8
Index of industrial stock prices (Dow-Jones)[1]	7.4	6.7	5.6	7.3	6.2	6.7	6.5
Pig iron production	14.1	7.6	9.0	10.9	12.8	10.6	10.6
Discount rate on 60–90 day commercial paper	13.7	11.6	10.6	8.8	7.6	10.8	11.3
Interest rate on call loans	31.6	36.6	33.0	18.9	12.0	28.0	30.6

[1] This is the Dow-Jones index for the period since 1897. For the years 1890-1896 the index computed by the Reports Department of the Federal Reserve Bank of New York, which carried back the Dow-Jones index by months to 1872, has been used. A full description of the measure will be found in *Interest Rates and Stock Speculation*, by Owens and Hardy (N. Y. Macmillan, 1925, Institute of Economics Series) pp. 139-144.

Measures of variability similar to those given above have been computed from the monthly values of a weighted index of railroad stock prices constructed by Frederick R. Macaulay. (This index, with an account of its construction, will appear in an early publication of the National Bureau of Economic Research.) The measure of monthly variability during the period 1890-1925 has a value of 4.3; for the same period, excluding 1914-1921, the value is 4.5. These are appreciably lower than the corresponding measures for industrial stocks.

In considering the significance of these figures it should be recalled that each of the eight-year averages rests, ultimately, upon 96 monthly price quotations, while the average for the four years, 1922-1925, rests upon 48 monthly quotations.

It is clear from Table 4 that individual commodities differ materially in the matter of price variability and, also, that the variability of specific commodities has changed from period to period. Thus the index for petroleum, which had stood at 9.0 and 9.4 during the first two periods, declined to 2.9 during the third period. As opposed to this, the index for rubber increased from 3.9 to 10.9 between the second and the third periods.

Since the pre-war years were divided into three eight-year periods, the relations between the averages for the first and third periods may be compared, in determining whether the tendency between 1890 and 1913 was in the direction of greater or less variability in the prices of individual commodities. Of the total number of commodities for which measures of monthly variability over the entire period have been computed (206), the prices of 78 were marked by increasing variability during the years from 1890 to 1913, 9 showed no change in the matter of price variability, and the prices of 119 became less variable. The general tendency was in the direction of declining variability.

These measures of variability by periods may be used to answer another question of some current interest. The last average given relates to the four years, 1922-1925. Was the variability of individual commodity prices during these years greater or less than during the years immediately preceding the war-time disturbances? This question may be answered, for any commodity, by comparing the average for the four years, 1922-1925, with the average for the eight-year period, 1906-1913. Of the total number of commodities studied, the prices of approximately two-thirds were more variable during the years 1922-1925 than they were during the eight pre-war years. The influence of the war-time disturbances upon individual prices has persisted, apparently, and, in so far as the four years from 1922 to 1925 may be used as a criterion, has left us with more variable prices than we had during the years immediately preceding the war.

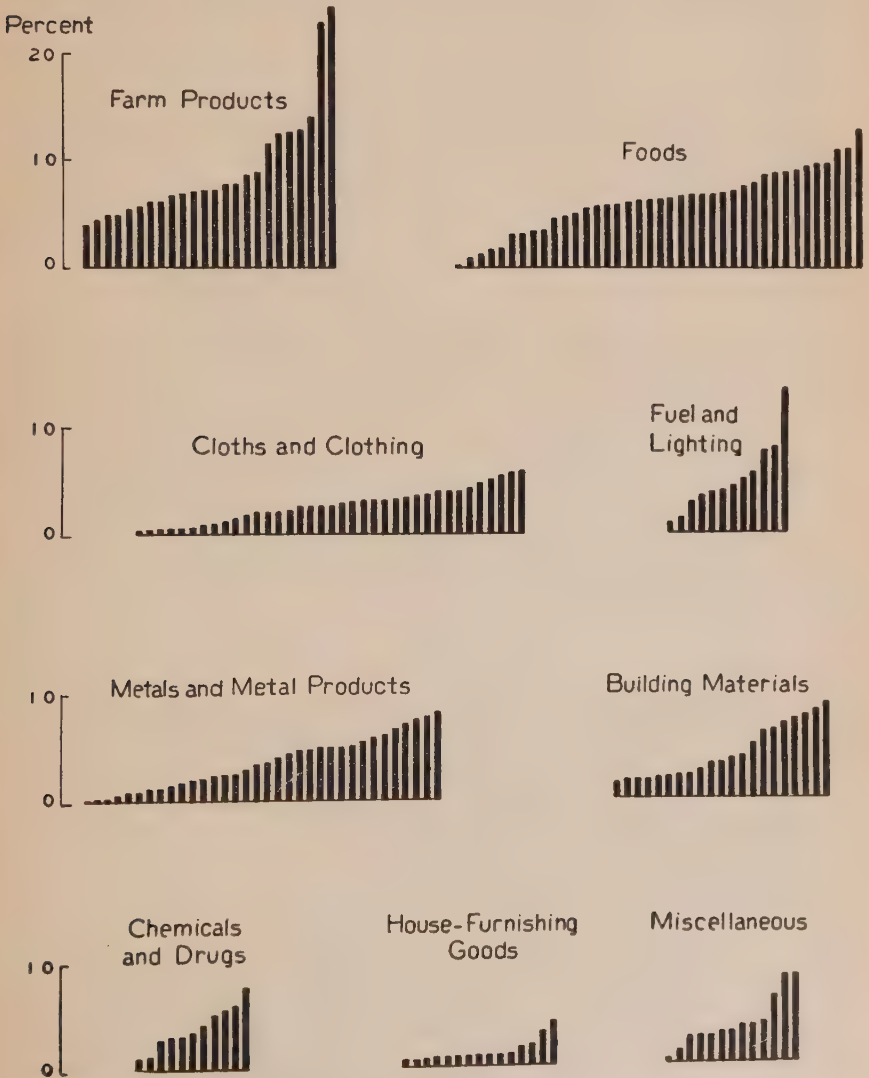
The general averages of monthly price variability, which are given in columns (8) and (9) of Appendix Table IV and of Table 4 of the text, may be used in comparing commodities in respect to their "proper fluctuations." To facilitate this comparison the commodities listed in these tables are arranged in order of magnitude of

FIGURE 3

VARIABILITY OF COMMODITY PRICES, AT WHOLESALE.

Ranking of Commodities by Groups according to the Monthly Variability of Prices.[1]

(Averages based upon monthly prices for the period 1890-1925, excluding 1914-1921.)



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[1] Values of the variability measures for specific commodities are given in the Appendix, in order of magnitude, by groups, as plotted in this diagram. See Table VI for farm products and foods, and Table IV for all other groups.

the averages for the period 1890-1925, excluding 1914-1921. In Table IV the arrangement is by commodity groups, the groups being those employed by the United States Bureau of Labor Statistics.[1] A second arrangement of farm products and foods is made in Table VI, where crop year measures are used in determining the ranking of individual commodities.

The final averages in Table 4 range from 2.2 for steel rails to 13.9 for coke. The measures in the general table extend from .02 for trowels to 24.4 for onions. The variation within each group is shown by Figure 3, in which the data of Table IV are graphically presented. (The sections of the chart relating to farm products and foods follow the ranking of Table VI.) The wide differences between the measures for different commodities give evidence of the diversity of forces which are responsible for fluctuations in the prices of economic goods.

In comparing the measures for different commodities given in the preceding and certain following tables the differences in the original price quotations should be borne in mind.[2] Some of the original prices are averages of quotations at several plants or in several markets.[3] This prior averaging would tend to lessen the price variability of these commodities, as compared with other commodities for which quoted prices relate to a single market or a single plant. Again, some monthly prices are averages of daily or weekly quotations, while others are those prevailing on the first or fifteenth of the month. It is stated by the Bureau of Labor Statistics, however, that prices prevailing on the first or fifteenth of the month are taken only for those commodities which are quite stable in price. This being so, the measures of variability are probably not materially affected by the methods of securing price quotations.[4]

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[1] The groups are those employed by the Bureau of Labor Statistics prior to the recent revision of its index number of wholesale prices.

[2] See Appendix Table I for a full description of the various commodities and their price quotations.

[3] This is true, for recent years, of the quotations on matches (average of 3 varieties) and common lime (average of 15 plants).

[4] A minor difficulty in the measurement of variability arose from the form in which actual prices are published by the Bureau of Labor Statistics. These prices are given to three decimal places, a form which is retained whether the price falls in the neighborhood of thirty dollars per unit (as for steel billets) or seven mills per unit (as for sulphuric acid). Thus the 1925 average price of steel billets is given as $35.452 (per ton) while the price of sulphuric acid is given as $.007 (per pound). A change of 1-100th of one per cent would be recorded for the former, while a change of ten per cent might not be reflected in the published price of the latter. It has been possible to meet this difficulty, in part, by using the relative prices which the Bureau publishes (which are always given to the first decimal place), but these relatives do not meet the needs of those whose interest lies in the actual prices. These needs would be best served, it

Difficulties of the same sort arise when measures of variability for different periods are compared. A radical alteration in the method of securing monthly prices might destroy the homogeneity of a series, for the present purpose.[1] The only general change of this nature made by the Bureau of Labor Statistics was in substituting average monthly prices (based on daily or weekly quotations) for first-of-the-month quotations. This change was made within recent years in computing the monthly prices of some 74 commodities, most of which were agricultural products, foods, or textiles. It is impossible to determine the effect of this substitution upon the magnitude of the monthly fluctuations, but there is no reason to believe that it has been material. In spite of these changes in the methods of securing certain quotations, the price series of the Bureau of Labor Statistics have been accepted as homogeneous for the purposes of the present study.[2]

2. THE MEASUREMENT OF YEAR-TO-YEAR VARIABILITY

The variation of prices within the year represents a composite of secular, seasonal, cyclical and accidental factors. The fluctuations of commodity prices from year to year are due to a somewhat different set of forces. The seasonal element is not present. The influence of such accidental factors as affect prices over short periods only is eliminated, in large part. Cyclical swings, year-to-year variations due to crop changes or other factors affecting supply or demand, and the influence of trend are all present in the fluctuations of annual average prices.

The measure of year-to-year variability employed in the present study is the mean deviation (from the mean) of link relatives of average annual prices. The materials for such a measure were readily available, and the labor of computation was not excessive.

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would appear, if all price quotations were given to the same number of *significant* figures. It is understood that the Bureau of Labor Statistics is planning to follow a somewhat different practice in publishing certain of its price series, aiming to eliminate the difficulty mentioned above.

[1] Professor W. M. Persons was led to reject eight of the price series published by the Bureau of Labor Statistics because there was doubt as to their homogeneity. These were men's hose, brown sheetings, serge dress goods, worsted trouserings, white pine doors, bedroom sets, men's boots, and smoking tobacco. (See "A Commodity Price Index of Business Cycles," *Review of Economic Statistics*, Prel. Vol. 3.) The rejection was, of course, based upon the needs of a particular investigation.

[2] The only exceptions are two series of prices relating to pails and tubs. Each of these series was spliced in 1914 by the substitution of galvanized iron vessels for wooden articles. These spliced series were rejected, in computing the present measure, because of the organic difference in the materials employed. In certain of the later calculations these were treated as consistent series.

This practical reason was reënforced by theoretical considerations. In measuring price variability it seems desirable to take account of the actual changes which occur from year to year, for it is these changes which affect business dealings and economic relations. The chief alternative measure, based on deviations from a line of trend, involves the use of a somewhat arbitrary base point for each year's calculations, a base point which becomes quite artificial and meaningless unless the fit of the trend line is satisfactory. Even when the fit is good it is questionable whether a measure of the variability of a time series should be based upon deviations from a line of trend. Actual fluctuations, not departures from a hypothetical trend, are the significant manifestations of variability. In these computations, accordingly, price changes from year to year are employed, instead of deviations from lines of trend. The effect of trend is in part eliminated, however, since the deviations which affect the value of the measure of variability are departures from the mean value of the link relatives for the period covered. In the case of a series increasing at a constant rate of 2 per cent a year, each of the annual link relatives would have a value of 102, and the mean deviation would be zero. In effect, then, the mean deviation of link relatives measures the variability due to departure from a constant rate of increase or decrease. When the rate of change is not constant, however, the averaging of deviations from the mean of the link relatives is not equivalent to averaging deviations from a line of trend.

a. *Year-to-Year Variability of Wholesale Prices.* In the analysis of wholesale prices two measures of annual variability have been computed for each commodity, one restricted to the pre-war years, 1890-1913, the other based upon average annual prices for the period 1890-1924. In measuring the variability of certain agricultural products, measures have been secured for both crop year and calendar year variability. All the results are shown in Table VII. The commodities within each group are arranged in order, according to the magnitude of the measures of pre-war variability. The ranking is based upon crop year measures, where these have been computed, but in these cases the measures of calendar year variability are also given.

Figures relating to nineteen selected commodities are given in the following table, the commodities being arranged according to degree of variability during the period 1890-1913. For purposes of comparison measures of year-to-year variability relating to certain other economic series have been included in this table.

TABLE 6

Measures of Year-to-Year Variability of Prices of Selected Commodities, at Wholesale, and of Six General Economic Series

(1) Ref. No.	(2) Commodity	(3) Measures of variability[1] 1890–1913	(4) Measures of variability[1] 1890–1924
441	Leather	5.0	7.8
233	Anthracite coal	5.4	5.5
236	Bituminous coal	7.2	12.3
280	Steel rails	7.8	9.7
64	Beef	8.0	8.8
13	Cattle	9.1	10.5
149	Sugar, raw	9.4	14.2
202	Cotton yarns	9.9	16.2
120	Flour, wheat	11.2 (9.2)	15.5 (12.3)
195	Print cloths	11.7	17.9
6	Wheat	12.8 (11.7)	16.8 (13.9)
293	Copper, ingot	13.3	15.2
259	Pig iron	13.5	19.3
276	Steel billets	15.6	21.3
451	Rubber	15.9	16.6
25	Cotton	16.2 (14.2)	20.4 (18.2)
247	Petroleum	19.4	20.8
239	Coke	21.2	36.3
51	Potatoes	53.6 (34.5)	54.4 (39.4)
	Yield on fifteen railroad bonds	2.9	3.7
	Index of general business conditions (A. T. & T.)	6.9	7.7
	Index of industrial stock prices (Dow-Jones)[2]	14.2	14.3
	Pig iron production	16.0	20.3
	Discount rate on 60–90 day commercial paper	21.1	21.4
	Interest rate on call loans	50.0	42.2

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[1] Where but one measure is given for a single commodity, it relates to calendar year variability. Where two are given, the first is based upon crop year prices, the second (in parentheses) upon calendar year prices.

[2] The corresponding values for Macaulay's index of railroad stock prices are 10.5, for the period 1890-1913, and 9.6, for the period 1890-1924.

The measures of pre-war price variability in Table 6 range from 5.0 for leather to 53.6 for potatoes, a range considerably in excess of that found in comparing measures of monthly variability. In the general table the range extends from .2 for trowels to 53.6 for potatoes.

Although there are certain notable differences in the ranking of individual commodities in respect to monthly and annual variability, there is some relation between the arrangement of commodities in the general tables (IV and VI, and VII). We have comparable measures for 206 commodities. The coefficient of correlation between measures of monthly variability, averaged for the years

1890-1913, and measures of year-to-year variability computed from average annual prices over the same period, has a value of +.70. This value suggests that the elements responsible for differences between commodities in respect to monthly price variability are only in part identical with the factors to which individual differences in year-to-year variability are due.

b. *Year-to-Year Variability of Retail Prices.* The measures of variability given in the preceding table have all been computed from wholesale prices. No such comprehensive series of quotations is available for retail markets, but the Bureau of Labor Statistics has compiled average annual prices for a limited number of foods at retail for the period since 1890. Although annual prices for only thirteen articles are obtainable for the entire period since 1890, some interest attaches to measures of variability computed from these figures. Each annual retail price is secured, it should be noted, by averaging prices prevailing in different cities. The number of dealers and the number of cities covered have varied somewhat. For the last several years merchants in 51 cities have reported their prices. Such averages would, of course, tend to fluctuate less than would average annual prices drawn from a single market. For these reasons it is not proper to compare the measures of wholesale price variability given in Table 6 with the retail measures following. Comparison of the different commodities for which retail prices are given is legitimate, however.

TABLE 7

MEASURES OF YEAR-TO-YEAR VARIABILITY OF FOOD PRICES, AT RETAIL

(Based upon calendar year averages for the United States, as computed by the United States Bureau of Labor Statistics)

(1) Commodity	(2) Measures of variability 1890–1913	(3) Measures of variability 1890–1924
Milk	1.4	4.0
Hens	2.9	5.2
Round steak	3.0	4.5
Butter	3.6	6.3
Eggs	3.7	5.9
Ham	3.8	5.9
Pork chops	4.1	6.7
Corn meal	4.2	8.0
Sugar	4.3	10.5
Bacon	4.4	7.0
Flour	5.7	8.7
Lard	7.0	10.2
Potatoes	10.6	17.5

The range of values within which these measures fall is distinctly smaller than that for wholesale prices, but within this range there are important differences between individual commodities. These differences would doubtless be much more pronounced if the price quotations employed were drawn from single markets, as is done for most of the wholesale price quotations.

c. *Year-to-Year Variability of Farm Prices.* For a limited number of agricultural products the averages of farm prices[1] prevailing on December 1st of each year are available, for the period covered by this study. Each annual price for the United States is secured by averaging the farm prices prevailing in the several states on December 1st. The annual figures thus differ in important respects from the wholesale price averages employed in computint the figures given in Table 6 and from the retail price averages upog which Table 7 is based. The figures given below, relating to eighn important farm products, are therefore not directly comparable with the wholesale and retail measures. The different entries in Table 8 may, however, be compared with each other.

TABLE 8

MEASURES OF YEAR-TO-YEAR VARIABILITY OF FARM PRICES OF SELECTED AGRICULTURAL PRODUCTS

(Based upon averages, for the United States, of December 1st farm prices, as computed by the United States Department of Agriculture)

(1) Commodity	(2) Measures of variability 1890–1913	(3) Measures of variability 1890–1924
Rye	10.5	15.6
Hay	10.6	11.7
Wheat	12.5	16.2
Barley	13.7	18.4
Oats	17.4	18.3
Corn	19.5	22.3
Cotton	22.1	27.4
Potatoes	32.7	33.9

An interesting feature of this table, in comparison with that relating to prices in the wholesale markets, is found in the difference in the relative positions of the five grains. In the wholesale markets the ranking of the five grains, based upon year-to-year price variability (1890-1913), is wheat, rye, corn, barley and oats, wheat being least variable. The farm price of rye is least variable, with wheat next in line. Barley is third (of the grains) in the farm price list and fourth in the wholesale price list, while oats are fourth in the farm price and fifth in the wholesale price list. The ranking of corn based on farm prices is fifth, as compared with a third place in the other list.

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[1] Farm prices are the prices received by producers.

It was suggested above that the comparison of actual values in the farm price and in the wholesale price lists is not justified. The farm prices, being averages for the United States, would tend to be more stable than would wholesale price quotations in a single market.[1] On the other hand, the farm prices are December 1st prices, while the wholesale prices are averages for the year. We may come as close to perfect comparability as is possible with the available data by comparing farm prices prevailing on December 1st in a single state with December prices in a given wholesale market. This has been done in preparing the following table. For each of the six commodities listed, the year-to-year variability of December 1st farm prices in the chief (or a leading) producing state has been computed. This measure is compared with the year-to-year variability of average December wholesale prices in Chicago

TABLE 9

Relative Variability of Prices of Six Farm Products

Comparison of Measures of Year-to-Year Variability of December Farm Prices in Specific States and December Wholesale Prices in Chicago*

(1)	(2)	(3)	(4)	(5)
	Measures of variability			
	1890–1913		1890–1924	
Commodity	Farm prices	Wholesale prices	Farm prices	Wholesale prices
Wheat	15.8	13.6	18.1	17.9
Rye	18.6	17.2	25.4	22.8
Barley	20.9	20.7	25.3	24.1
Oats	26.1	22.5	25.8	22.6
Corn	29.7	23.0	30.7	26.4
Potatoes	48.9	47.5	53.7	47.3

*The wholesale prices to which the above measures relate are cash Chicago prices. The farm prices are those prevailing on December 1st in the following states:

Wheat: Kansas
Rye: North Dakota
Oats: Iowa
Barley: North Dakota
Corn: Iowa
Potatoes: Minnesota

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[1] The stabilizing effect of the averaging process is apparent from a comparison of the following figures, measuring the year-to-year variability of December 1st farm prices of

It is clear that the year-to-year variability of December farm prices in the chief producing states is greater than the year-to-year variability of December wholesale prices in Chicago. The ranking of the grains in the matter of price variability is the same for both farm and wholesale prices, when the study is restricted to pre-war prices. The inclusion of prices for the years 1914-1924 changes the ranking slightly.

§Week-to-Week Variability of Prices

As an illustration of another type of variability, results secured by C. E. Artman in studying wholesale prices of fruits and vegetables in the New York market may be cited. His measures relate to week-to-week variability within a single market for a single season, a type of variability quite distinct from the monthly and year-to-year variability which have been discussed above. As a measure of variability Artman employed "the average week-to-week change in price, either up or down, expressed as a percentage of the season's mean wholesale price for the given commodity." The following measures of variability were secured:

Northern potatoes	3.2	Yellow onions	13.5
Boxed apples	4.6	Western lettuce	19.6
Sweet potatoes	5.4	Cantaloupes	22.8
Barreled apples	8.0	Peaches	24.1
California oranges	9.2	Southern cabbage	25.9
Southern potatoes	11.8	Eastern lettuce	26.4
Northern cabbage	12.8		

(From: C. E. Artman, *Food Costs and City Consumers*, Columbia University Studies, No. 280, p. 90.)

Artman points out that this grouping of commodities according to week-to-week variability in wholesale prices agrees in general with their ranking in regard to perishability.

oats in 10 states, and in the United States. The measures are computed from prices for the years 1890-1913.

Region	Measure of year-to-year variability of farm prices of oats, 1890-1913 (based on December 1st prices)
California	10.9
Ohio	17.0
Minnesota	18.5
Wisconsin	19.5
Texas	19.7
Indiana	20.3
Illinois	21.5
South Dakota	22.4
Nebraska	22.5
Iowa	28.7
United States	17.4

Most of these articles are not duplicated in the tables above, nor in the general tables in the Appendix. The difference in the position of potatoes is perhaps the most notable feature. In week-to-week variability during the marketing season, which is apparently a function of perishability, potatoes rank low in comparison with other fruits and vegetables, but their monthly and year-to-year price variability is high.

3. MEASUREMENT OF THE FREQUENCY OF MONTHLY PRICE CHANGES

It is desirable, in measuring the variability of commodity prices, to take account of the frequency of change as well as the degree of change in prices. The smallest time unit covered by the available data is the month, so that we are restricted to a study of the frequency of change in monthly prices. A smaller time-interval would be desirable in a comprehensive investigation of frequency of price change.

The question of the comparability of the different price series employed must be carefully considered in such a study. We must distinguish all price series which are averages of a number of constituent series, for such averages could not legitimately be compared, in respect to frequency of change, with price series taken from a single market or the files of a single manufacturer.[1] A second difficulty arises in comparing commodities the prices of which are quoted as of a given day of the month (first or fifteenth) with commodities for which the monthly prices are secured by averaging daily or weekly quotations. Only for those commodities which remain constant in price over an extended period is it the practice of the Bureau of Labor Statistics to use a quotation relating to a single day of the month. In general, for such commodities, the average price for the month would presumably be the same as the price on the first or fifteenth of the month. It has been considered justifiable, therefore, to compare commodities for which monthly prices are secured in these various ways, though the data are not in the most satisfactory shape for the purpose. In utilizing and interpreting the results, the sources of the individual price quotations (as listed in Table I) must be borne in mind. In some cases differences in frequency of change may be attributed to the source of the quotation (e. g. when plant prices for one commodity are compared with prices for another on a commodity exchange), but differences of this sort are not without significance.

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[1] In the list of commodities for which measures of frequency of price change have been computed in the present study there are only two for which price quotations represent averages (i. e., averages of prices at different plants or in different markets) during any part of the period covered. These are matches (commodity no. 244) and lime (commodity no. 338). Since 1913 the published prices on the first of these have represented averages of prices on three grades, while the published prices for lime have been secured by averaging prices at fifteen plants. The effect on the frequency of change in the prices of matches is not apparent in the figures, but the alteration in the lime quotation is probably the main factor in the great apparent increase in the frequency of price change in post-war years. For the period 1906 to 1913 the measure of frequency of price change for lime had a value of .10; for the years 1922 to 1925 the value was .98.

The measure employed in studying the frequency of price change for a given commodity is a simple one. It is the ratio of the number of price changes to the total number of months, less one, for which prices are available. Thus if the price of a commodity were quoted for 240 months, and if in 239 of these months price changes were recorded, the index of frequency of price change would be given by the ratio 239/239, or 1.00. The denominator is taken as the total number of cases less one, since the first month of the series cannot be compared with the month preceding. The maximum value of the ratio is, therefore, unity. A value of zero means, of course, that there have been no price changes during the period covered.[1]

As in the case of the index of monthly variability, the measure of frequency of price change has been computed by periods. These measures are shown for all commodities in Appendix Table VIII, and for nineteen selected articles in Table 10, below. The changes from period to period, which were noted in the case of the other index, are also found in these tables. The measure of frequency of change for coke increased from .38 to .92 between the first and third periods; that for petroleum declined from .97 to .24. When the measures of frequency of price change for all the commodities studied (206) are examined, by periods, there is found a rough balance between the number which showed an increase in the frequency of change and those which showed a decrease, during the period 1890-1913. The frequency of price change declined for 95 commodities, increased for 92 and remained constant for 19.

Comparing the figures for the four years, 1922-25, with those for the last pre-war period, 1906-13, we find the same tendency toward greater variability in the post-war years which was observed in the study of the measures of monthly variability. Of the 206 articles listed in Table VIII, 137 showed an increase in the fre-

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[1] Variations in the number of significant figures in the various price quotations of the Bureau of Labor Statistics lessens somewhat the comparability of the results for different commodities. The effect of these variations upon the measures of frequency of price change is probably not great, however.

TABLE 10

MEASURES OF FREQUENCY OF MONTHLY CHANGES IN PRICES OF SELECTED COMMODITIES, AT WHOLESALE, BY PERIODS, 1890-1925

(1) Ref. No.	(2) Commodity	(3) 1890–1897	(4) 1898–1905	(5) 1906–1913	(6) 1914–1921	(7) 1922–1925	(8) 1890–1925 inclusive	(9) 1890–1925 excluding 1914–1921
280	Steel rails	.23	.18	.00	.14	.04	.13	.12
236	Bituminous coal	.71	.37	.25	.27	.37	.38	.41
441	Leather	.37	.56	.43	.44	.54	.46	.46
247	Petroleum	.97	.41	.24	.46	.73	.54	.56
239	Coke	.38	.60	.92	.72	.98	.69	.68
202	Cotton yarns	.66	.72	.71	.91	.98	.78	.74
259	Pig iron	.61	.84	.79	.68	.92	.75	.77
149	Sugar, raw	.69	.79	.74	.70	1.00	.76	.78
276	Steel billets	.99	.82	.68	.69	.69	.79	.81
195	Print cloths	.93	.87	.81	.93	.94	.89	.88
293	Copper, ingot	.90	.82	.94	.84	.94	.88	.89
233	Anthracite coal	.95	.93	.89	.95	.98	.93	.93
451	Rubber	.93	.95	.95	.87	.98	.93	.95
64	Beef	.96	.98	.93	.99	.98	.96	.96
25	Cotton	.98	.98	1.00	1.00	1.00	.99	.99
13	Cattle	.98	1.00	1.00	.99	1.00	.99	.99
120	Flour, wheat	1.00	.98	1.00	1.00	1.00	.99	.99
51	Potatoes	1.00	99	1.00	.99	1.00	.99	1.00
6	Wheat	1.00	1.00	1.00	.91	1.00	.98	1.00

quency of price change in the years following the war, 43 showed a decline, while for 26 the pre-war and post-war measures were equal.

In addition to the measures of frequency of price change by periods, two general measures are given in these tables. One is based upon monthly prices over the entire period from 1890 to 1925, the other upon the same quotations, excluding the disturbed years from 1914 to 1921. The latter is probably the more representative measure of frequency of price change. The commodities listed in Tables 10 and VIII are ranked on the basis of this measure.

The range in Table 10 extends from .12, for steel rails, to 1.00, for potatoes and wheat. These figures mean that a change in the price of steel rails was recorded in 12 per cent of the months for which prices were available, while potatoes and wheat changed in price every month during the period covered. The lowest value in the general table (VIII) is .01 (actually .006) for crosscut saws and trowels. A change in price took place for these articles in less than one month out of every hundred.

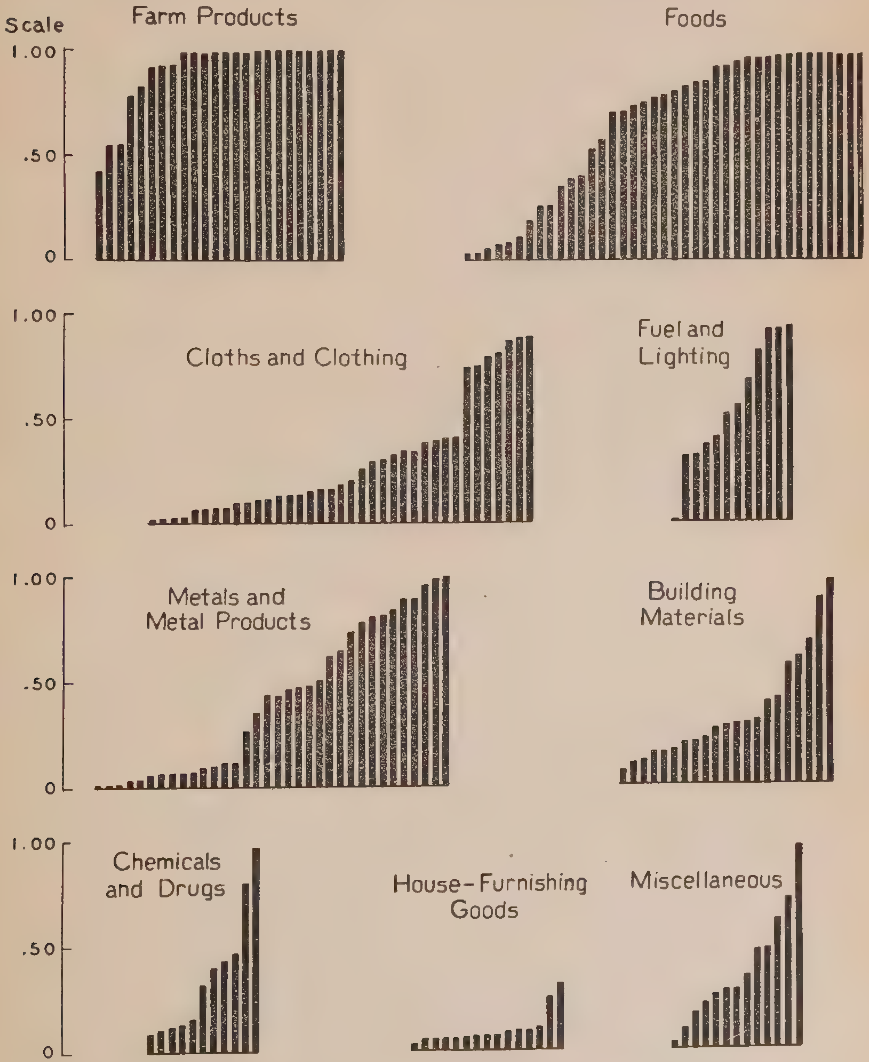
In Figure 4 the indexes of frequency of price change for 206 commodities are plotted, by groups.

FIGURE 4

Frequency of Change in Commodity Prices, at Wholesale.

Ranking of Commodities by Groups according to the Frequency of Month-to-Month Price Changes.[1]

(Measures based upon monthly prices for the period 1890-1925, excluding 1914-1921.)



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[1] Values of the measures of frequency of change for specific commodities are given in Table VIII, in order of magnitude, by groups, as plotted in this diagram.

Three different measures of price variability have been given in the preceding pages. Some degree of relationship between these different indexes is to be expected, since they measure, in part, the effects of the same forces. The coefficients of correlation measuring these relations are given below:

Series correlated	No. of observations	Coefficient of correlation[1]
Measure of monthly variability Measure of year-to-year variability	206	+.70
Measure of year-to-year variability Measure of frequency of monthly price change	206	+.58
Measure of monthly variability Measure of frequency of monthly price change	206	+.73

Although these coefficients indicate that the different measures of price variability are not independent, they show, as well, that there are important differences between them. The factors responsible for these three types of price variation are in part common, but each measure reflects, in addition, the influence of specific factors which affect one type of price movement alone.[2]

§Other Measures of Price Variability

It would be possible to develop numerous other measures of price variability, but the main purposes of the present investigation are served by the three described above. The effects of seasonal and other causes of short-term variability are adequately measured by the first of these; the effects of major cyclical swings and of crop and other factors which cause commodity prices to vary from year to year are measured by the second. The third gives some indication of the degree of control exercised in the fixing of the various commodity prices, and throws some light on the nature of the price competition prevailing in different lines.

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[1] In a few of the cases tested in this study slightly higher measures of correlation would be secured if non-linear, rather than linear relationships, were assumed. Such cases are few, however, and it does not appear from inspection that the differences would be pronounced. It has been considered advisable, therefore, to assume linear relationships and to employ the coefficient of correlation throughout.

[2] One important group of prices has been omitted in the preceding analysis. These are contract prices, which are of considerable importance in certain basic industries. It is certain that the behavior of contract prices in the matter of variability, and in other respects, differs materially from the behavior of the market and farm prices to which the above discussion relates. It is hoped that a comprehensive study of contract prices may be made at a later time.

The problem of measuring price variability has been faced in certain other studies dealing with specific commodities. A brief account of the measures employed is pertinent.

In various investigations of the effect of speculation upon price fluctuations, use has been made of the monthly or annual range (i. e. the difference between the highest and the lowest prices). In some cases this range has been expressed as a percentage of the average. Whether in absolute or relative form, however, this is a measure of limited significance. The difference between the results secured by the employment of the range and those obtained by other methods is well illustrated by figures relating to wheat, barley and oats. James E. Boyle (*Speculation and the Chicago Board of Trade*, N. Y. Macmillan, 1920, pp. 122-3) contending that "Speculation on the organized exchanges lessens (price) fluctuations," presents as proof measures of the price variability of these three grains, computed from prices for the years 1899-1916. These measures are the "extreme price ranges for each year" expressed, apparently, as percentages of the average price for each year. The fluctuations are smallest in wheat prices and greatest in the price of barley, with oats falling between. From which Dr. Boyle concludes that future trading tends to stabilize prices, since wheat and oats are traded in on the organized exchanges while barley is not. The difference between oats and barley is emphasized by Dr. Boyle. Pointing out that oats and barley are similar in their production and use, he concludes that the difference in their price variability may be attributed to the fact that one is dealt in on the exchanges, while the other is not.

From the tables presented above we have the following figures relating to these three grains:

TABLE 11

MEASURES OF PRICE VARIABILITY FOR WHEAT, BARLEY AND OATS

(1) Grain	(2) Monthly variability 1890–1925	(3)	(4)	(5)	(6) Year-to-year variability 1890–1924	(7)	(8)	(9)
	Calendar year		Crop year		Calendar year		Crop year	
	incl. 1915–22	excl. 1915–22	incl. 1914–15 to 1921–22	excl. 1914–15 to 1921–22	1890–1913	1890–1924	1890–91 to 1913–14	1890–91 to 1924–25
Wheat	7.7	7.0	6.6	5.5	11.7	13.9	12.8	16.8
Barley	9.9	9.0	7.1	6.2	16.4	16.3	17.8	20.6
Oats	10.8	11.0	7.6	6.8	16.1	16.6	19.8	20.3

In the eight different comparisons we find barley more variable than oats only twice. In these two cases the differences are very slight. In the six other cases the variability of barley prices is less than that of the prices of oats. Wheat, in all cases, is less variable in price than the two other grains.

The differences between the two sets of results for barley and oats may be in part due to differences in the periods covered. (The prices employed in the present study cover a longer period of years than those quoted by Dr. Boyle.) More important, however, is the fact that Dr. Boyle's figures relate to the annual range of price fluctuations, while the figures tabulated above measure average monthly movements and average year-to-year changes. In interpreting the results, a clear distinction should be made between the different types of price variability which are being measured. If we have in mind either average monthly variations or year-to-year changes, no such conclusion as that drawn by Dr. Boyle appears to be justified.

Of more general significance than the crude range employed by Dr. Boyle is the standard deviation, which was used in an early report on future dealings in raw produce (chiefly wheat) made in 1900 by a committee of Section F (Economic Science and Statistics) of the British Association, and later by Chapman and Knoop in a paper on "Dealings in Futures on the Cotton Market" (*Journal of the Royal Statistical Society*, Vol. 69, 1906). Chapman and Knoop used, in computing this measure, the deviations of weekly prices from crop-year averages. In both these studies the standard deviation was supplemented by a measure of the mean weekly (or daily) movement. Similar measures have been employed in various other studies dealing with speculation and commodity prices.

Abraham Berglund, studying fluctuations in steel prices ("The United States Steel Corporation and Price Stabilization," *Quarterly Journal of Economics*, November, 1923) employed measures of variability based upon extreme fluctuations. Berglund considered these more significant for his purpose than any measure of average deviation. Accordingly, he divided the interval 1898-1922 into three periods (1898-1901, 1902-1914, 1915-1922), determined the average price of finished steel in each of these periods, and measured the extreme deviations of monthly and annual averages, in each period, from these average prices. Use was made also of figures showing the extreme monthly deviations from annual averages. Throughout the emphasis was upon the widest fluctuations, not upon average deviations. While such a method may be desirable for certain purposes, no measure based upon isolated fluctuations can be considered generally satisfactory.

A more elaborate method, developed by G. P. Watkins (see "The Measurement of Concomitance of Variation," *Journal of the American Statistical Association*, March, 1923, June, 1923) has been employed by the Federal Trade Commission in studying the variability of grain prices. (The results appear in *The Grain Trade*; Vol. VI, *Prices of Grain and Grain Futures*.) The index of variability employed is derived from the antilogarithm of the average of the logarithmic differences between successive items in the original series, a correction for trend being applied before the logarithmic differences are averaged. In computing logarithmic differences, the smaller number is always subtracted from the larger, regardless of chronological order, hence we are dealing with the ratio of the larger to the smaller number in each pair. Careful testing has not shown that this index possesses any advantage over the simpler measure of variability here employed in measuring year-to-year movements. Allowing for the slight distortion of the logarithmic index due to the fact that the ratios which are averaged are always those of the larger of each pair to the smaller, the results secured from the two methods are very nearly the same, except when the variability is great. In such cases the preponderant influence of the large ratios (the smaller being the base in every instance) makes the logarithmic index considerably greater than that based on link relatives. There is, in both methods, some correction for trend. One employing the logarithmic method corrects each of the logarithmic differences by a proportionate part of the difference between the logarithms of the first and last entries in the series. The link relative method involves the measurement of deviations from the mean of all the link relatives. When the series increases at a constant rate, year by year, the two corrections for trend will agree, but they will give different results under other conditions.

The ranking of the grains according to year-to-year price variability, as given by the Federal Trade Commission (*The Grain Trade* Vol. VI. *Prices of Grain and Grain Futures*, pp. 27-8), differs but slightly from that secured in the present study. The corresponding measures are given below. They are based upon cash prices at Chicago, averaged by crop years. Since the Federal Trade Commission's averages do not include the years of greatest disturbance following upon the war, the measures derived in the present study from pre-war prices are given for comparison.

TABLE 12

MEASURES OF YEAR-TO-YEAR VARIABILITY OF THE PRICES OF FIVE GRAINS

(1) Grain	(2) Present inquiry 1890-91 to 1913-14	(3) Federal Trade Commission 1886-87 to 1915-16
Wheat	12.8	14.8
Rye	14.6	17.5
Corn	14.8	16.7
Barley	17.8	20.1 (1893-1916)
Oats	19.8	22.7

The absolute differences between the two sets of measures are not significant, since they are computed by different methods. The two rankings differ only with respect to the position of rye and corn, the former being second in the ranking based upon the present study and third in the Federal Trade Commission's ranking. The two studies agree in placing oats as the most variable of the grains in year-to-year price movements. In this their conclusions differ from those of Professor Boyle, based upon the range of annual fluctuations during the years 1899-1916.

More pronounced are the differences in ranking based upon the variability of monthly prices. The Federal Trade Commission has computed measures of monthly price variability (using the method described above) for the five grains, employing cash Chicago prices for the period from 1909 to 1914. These may be compared with measures based upon monthly cash prices at Chicago during crop years from 1890 to 1925, excluding 1914 to 1921.

TABLE 13

Measures of Monthly Variability of the Prices of Five Grains

(1) Grain	(2) Present inquiry 1890–91 to 1925–26 (excluding 1914–15 to 1921-22)	(3) Federal Trade Commission July, 1909, to June, 1914
Wheat	5.5	3.5
Barley	6.2	5.3
Rye	6.5	3.7
Oats	6.8	5.4
Corn	8.8	5.3

The methods of measuring variability differ more radically in this case than in the case of year-to-year movements. This fact, together with the difference in the periods covered, doubtless accounts for the differences in the results.

In *An Academic Study of Some Money Market and Other Statistics* (London, P. S. King, 1926) E. G. Peake gives measures of year-to-year variability in the prices of 43 articles which enter into Sauerbeck's index of wholesale prices in England. These are computed from fixed base relatives, the base being the average price, during the years 1867-77, of each commodity. The average of the year-to-year changes in these relatives furnishes a first measure of variability. Such an average has been computed for the periods 1850-1879 and 1880-1909. A second measure of variability, in relative form, has been secured by expressing each of these averages as a percentage of the average value of the fixed base relatives for the commodity in question over the period covered. The chief difference between Peake's measure of variability and the year-to-year measure employed in the present study lies in the nature of the original price relatives employed. Peake averages the difference between annual values of fixed base relatives; in the present inquiry annual link relatives have been employed in measuring year-to-year changes. The former method would give the same weight to a change in the relative price from 150 to 170 as to a change from 40 to 60. On the link basis the former represents an increase from 100 to 113.3; the latter represents an increase from 100 to 150. If a commodity undergoes a considerable change in price during the period for which year-to-year changes are to be averaged, the measure of variability computed by Peake's method would be somewhat distorted, giving undue weight to the changes occurring at the higher price level.

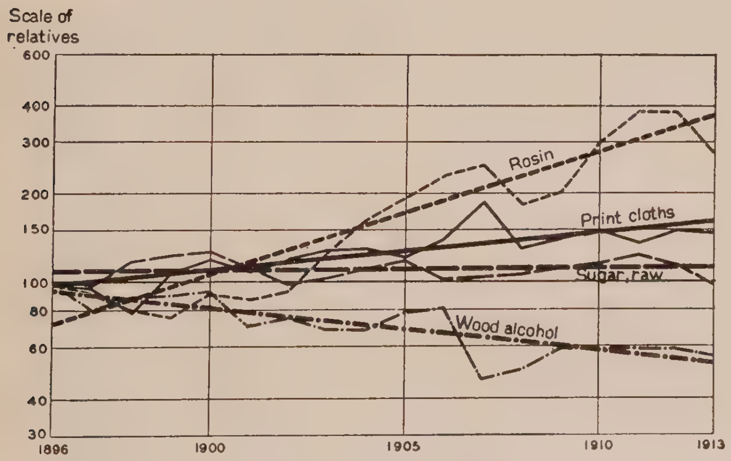
III Trends of Commodity Prices

If the prices of a number of commodities be plotted over a period of years, there will be observed notable differences between the rates at which the respective series have been increasing or decreasing. While the general price level may be moving upward at a fairly constant rate, as it was from 1896 to 1913, there will not be uniformity in the movements of individual commodities. Some will be moving at a higher rate than the general index, some at a lower rate, while some may be moving downward. The nature of these differences is graphically illustrated in Figure 5, showing the movements of the prices of four commodities during the period 1896-1913. (The prices have been reduced to relatives on the 1896 base, in order that the series might be comparable.)[1]

FIGURE 5

Relative Prices of Four Commodities, at Wholesale, 1896-1913, With Lines of Trend.*

(1896=100)



*Sugar, raw: $y=109.3\ (1.0006)^x$
Print cloths: $y=98.6\ (1.0285)^x$
Rosin: $y=71.5\ (1.1019)^x$
Wood alcohol: $y=94.4\ (.9663)^x$
(origin: 1896)

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[1] The 1913 relatives of these four commodities, taking the 1896 prices as 100, are as follows:

Wood alcohol	56.3
Raw sugar	96.7
Print cloths	146.2
Rosin	276.2

Such differences in trend as are revealed in the above graph are of considerable economic significance. They result, presumably, from differences in extractive or manufacturing conditions, or from differences in demand. They represent shifting economic relations, changes in the relative position of different groups of producers. Those commodities and commodity groups which are increasing in price at a greater average rate than the general index are increasing in purchasing power in the wholesale markets; those which are increasing at a lower rate are declining in purchasing power. (The reference is, of course, to the purchasing power per unit of each commodity.) Such long-term shifts in relationship may be accurately traced if comparable measures of trend may be secured.

1. The Measurement of Price Trends

If a great many commodity price series be studied it will be noted that most series are marked by fairly constant rates of change during the years from 1896 to 1913. The era of falling prices culminating in the middle '90's marks one limit to this period, while the price revolution of 1915-1921 sets another limit. The intervening period was an era of well-sustained growth in American industry generally, though it was broken by one major and several minor recessions. The long-term shifts in the relations between different commodities and commodity groups which took place during this period therefore possess great economic interest. They represent changes due to the action of the general forces which were shaping our economic development during this stage of industrial and commercial expansion. The broader economic reasons for studying the changes which were taking place during these years are, fortunately, supported by the practical consideration that the trends of most price series during this period may be measured without resorting to complex functions.

A suitable measure of the rate of increase of a series which is subject to irregular fluctuations but which is changing at a constant rate may be obtained by fitting a curve of the type $y=ar^x$. This is a curve which appears as a straight line on ratio paper. It is a great advantage of this exponential curve that the constant r has a simple and immediate significance for the present purpose. The value of r is the ratio which the trend or computed price for each year bears to the trend price of the year preceding. Thus if r has a value of 1.06, it means that the trend price for each year exceeds the trend price of the year preceding by 6 per cent. In other words, the average annual rate of increase of the series in question has been 6 per cent, when all fluctuations are smoothed out and the underlying trend alone is considered. Because of its simplicity of interpretation and because the exponential curve gives, in general, a good fit to most price series for the years 1896-1913, this measure has been used throughout the present study in measuring rates of change.[1]

The average annual rates of change in price during the years 1896-1913 are given in Table IX, for all the commodities studied. The measures for a selected list of commodities appear in column (3) of the following table. For the purpose of comparison similar measures relating to certain series of general interest are included in the table.

TABLE 14

Average Annual Rates of Change in Prices and Purchasing Power of Selected Commodities, at Wholesale, and in Seven General Economic Series 1896-1913

(1) Ref. No.	(2) Commodity	(3) Rate of change in price 1896–1913 percent	(4) Rate of change in purchasing power 1896–1913 percent
149	Sugar, raw	.2	—2.1
239	Coke	.5	—1.8
280	Steel rails	.9	—1.4
259	Pig iron	1.0	—1.3
293	Copper, ingot	1.0	—1.3
276	Steel billets	1.1	—1.2
120	Flour, wheat	1.8	— .5
441	Leather	1.9	— .4
236	Bituminous coal	2.1	— .2
233	Anthracite coal	2.3	— .1
451	Rubber	2.3	— .05
6	Wheat	2.6	.2
202	Cotton yarns	2.6	.2
64	Beef	2.6	.3
195	Print cloths	2.8	.5
13	Cattle	3.1	.8
247	Petroleum	3.5	1.1
25	Cotton	3.9	1.5
51	Potatoes	4.3	1.9
	Interest rate on call loans	— .2	
	Yield on fifteen railroad bonds	— .1	
	Discount rate on 60-90 day commercial paper	.7	
	Population of the United States	1.9	
	Index of wholesale commodity prices (U. S. B. of L. S.)	2.3	
	Index of industrial stock prices (Dow-Jones)*	3.4	
	Pig iron production	6.4	

*The corresponding value for Macaulay's index of railroad stock prices is 4.9.

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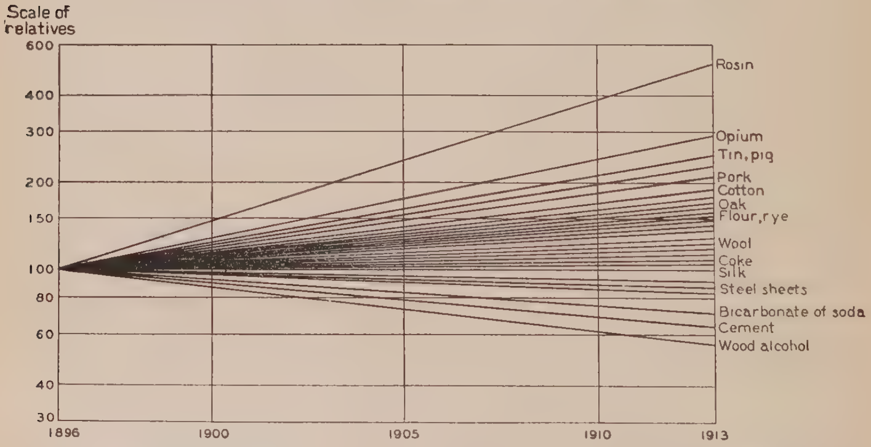
[1] The value of r has been determined, in each case, by the use of the mean value table constructed by Glover (see Glover's *Tables of Applied Mathematics*, Ann Arbor,

A graphic portrayal of the differing trends is afforded by Figure 6, on which are plotted the trend lines of a group of commodities. (Lines for other commodities are omitted, in order not to complicate the diagram.) Only the slopes of these lines, it should be observed, are significant. They are represented as branching from a common base in 1896, but that is merely to facilitate comparison. The impression which this chart conveys is of a multitude of price series rising or falling over a period of years at varying rates. The graph furnishes a true conception of the long-term shifts in price relations which reflect changes in economic processes and in general economic relations.

FIGURE 6

Illustrating the Diversity of Trends in Wholesale Commodity Prices.

Lines of Trend Measuring the Average Annual Rates of Change in Individual Commodity Prices between 1896 and 1913.



Michigan, George Wahr, 1923, p. 468). In addition to the great advantages of simplicity which this method possesses, it avoids distortions which result from fitting to the logarithms by the method of least squares. This latter procedure gives a line from which the sum of the squares of the logarithmic deviations is a minimum, a condition which lends greater weight to the lower values than would the least squares method if it could be applied to the natural numbers. With price series of the type dealt with here this is undesirable. Glover's method gives a more reasonable fit for the present purpose.

In some cases the straight line on ratio paper does not give as good a fit as would some other function. Even in these cases it has been employed as a measure of the average annual change during the period in question, and the r derived from the fitting process has been compared with and combined with similar figures for other price series. If our present purpose were the measurement of cyclical and accidental deviations from trend this procedure would not be justified in such cases, but the immediate object is something quite different. During the period covered (1896-1913) general commodity prices were following a course which could be very accurately represented by a simple exponential curve. This represents the combined influence of all the constituent series. Even though the constituent series did not in all cases follow the same type of trend, it seems justifiable to evaluate their general change during this period in terms of such a trend.

The rates for all commodities are plotted in Figure 7 in a form convenient for the comparison of individual commodities. Here they are grouped according to the Bureau of Labor Statistics classification, the commodities in each group being ranked in the order of magnitude of their rates of change. Measures have been computed for 223 commodities in all. The pronounced differences between these measures indicate the degree of change which was taking place in the relative positions of different commodities. The greatest rate of increase in price during the period 1896-1913 was registered by rosin, which rose at an average annual rate of 10.2 per cent.[1] Next below rosin stood opium, with a rate of 6.5 per cent. At the other extreme were wood alcohol, with a rate of —3.4 per cent per year, and quinine, —3.1 per cent. Detailed comment upon other individual figures is unnecessary at this point. In the second volume of this study outstanding differences between groups will be discussed in some detail.[2]

2. THE MEASUREMENT OF TRENDS IN PURCHASING POWER

If interest attaches to the relations between commodities, rather than to the absolute rates of increase or decrease in given prices during this period, the figures given in column (3) of Table 14 must be interpreted in their relation to the average annual rate of increase in the index number for all commodities during this period. For it is not the absolute rate of increase which is important, from the point of view of those interested in a particular commodity, but whether the commodity in question is increasing in price more

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[1] The significance of these rates will be clearer if the doubling period to which various rates of increase correspond be borne in mind. The following summary may be helpful in the interpretation of the results:

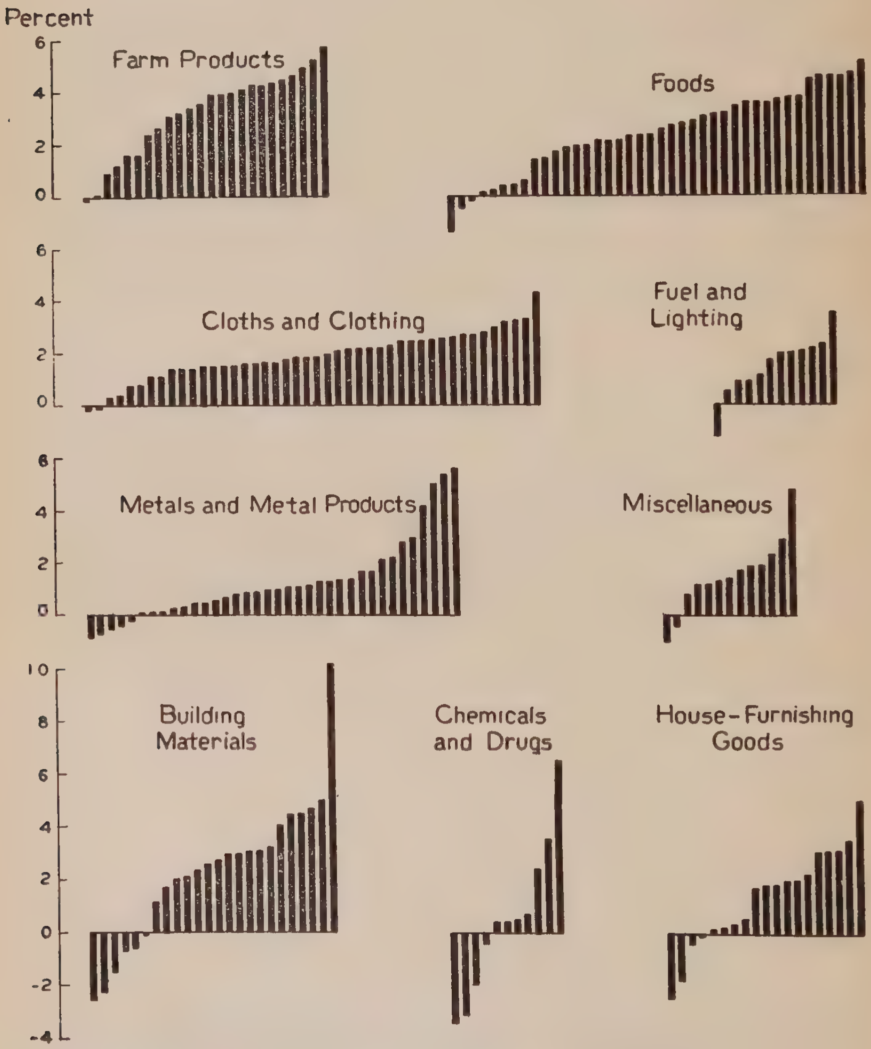
Average annual rate of increase	Approximate doubling period
1%	70 years
2	35 ”
3	23 ”
4	17 ”
5	14 ”
6	12 ”
7	10 ”
8	9 ”
9	8 ”
10	7 ”

[2] Julius Lehr, in *Beiträge zur Statistik der Preise* (Frankfort, 1885), made use of a measure identical with that employed above. An exponential curve was fitted to certain series, and rates of change, as measured by the constant r in the equations to the fitted curves, were compared. The method of fitting differed from that employed in the present study, but in other respects the procedure was the same.

FIGURE 7

AVERAGE ANNUAL RATES OF CHANGE IN COMMODITY PRICES, AT WHOLESALE.

Ranking of Commodities by Groups according to the Average Annual Rates of Change in their Wholesale Prices during the Period 1896-1913.[1]



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[1] The average annual rates of change for specific commodities are given in Table IX in order of magnitude, by groups, as plotted in this diagram.

or less rapidly than the average for all commodities. It is, therefore, the rate of change in purchasing power, or the change in value in terms of other commodities, which is the point of major interest in considering long-term movements such as these.

The average annual rate of change in the purchasing power of any commodity may be determined by fitting an exponential curve to the actual prices, deflated by a general price index. A shorter method is available, however. The rate of change in the deflated series may be derived directly from the figures for the rates of change in the general index and in the price of a specific commodity. If we divide the *r* of the specific commodity series by the *r* of the price index (the rates must for this purpose be expressed in full, i. e., as 1.0235, not as 2.35) we secure as quotient the *r* for the series which measures the purchasing power of that commodity.[1] Thus in the case of wheat, as listed in Table 14, we have *r* (purchasing power) $=\frac{1.026}{1.0235}=1.002$. This represents an average annual increase in purchasing power of .2 per cent.

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[1] We are to fit to certain data a curve of the type $y=ar^x$. Casting this into logarithmic form, we have

$$\log y = \log a + (\log r)\, x$$

The normal equations for fitting by least squares are

$$\Sigma \log y = n \log a + (\log r)\, \Sigma x$$

$$\Sigma (x \log y) = \log a\, \Sigma x + (\log r)\, \Sigma x^2$$

If the origin be at the middle of the period covered we have, as a general relation,

$$\log r = \frac{\Sigma (x \log y)}{\Sigma x^2}$$

If, now, we have three series, *A*, *B* and *C*, covering precisely the same period, the annual values of *C* being derived by dividing *A* by *B* (i. e. *A* is the original series, corresponding to the price of the specific commodity, *B* is the deflating series, corresponding to the general price index, while *C* is the deflated, or purchasing power series) we may write

$$(1) \quad \log r_A = \frac{\Sigma (x \log y_A)}{\Sigma x^2}$$

$$(2) \quad \log r_B = \frac{\Sigma (x \log y_B)}{\Sigma x^2}$$

$$(3) \quad \log r_C = \frac{\Sigma (x \log y_C)}{\Sigma x^2}$$

But $y_C = \frac{y_A}{y_B}$ or $\log y_C = \log y_A - \log y_B$

Substituting in (3) above

$$\log r_C = \frac{\Sigma [x (\log y_A - \log y_B)]}{\Sigma x^2}$$

$$= \frac{\Sigma (x \log y_A)}{\Sigma x^2} - \frac{\Sigma (x \log y_B)}{\Sigma x^2}$$

$$\log r_C = \log r_A - \log r_B$$

$$r_C = \frac{r_A}{r_B}$$

Similarly, it may be shown that $a_C = \frac{a_A}{a_B}$

(Footnote continued on next page.)

These methods possess considerable significance in affording a ready device for measuring changes in the values of given commodities in terms of other commodities. For it is these relationships, not absolute rates of increase or decrease, which are of economic importance. Having computed the average annual rates of change in the prices of individual commodities, and having a similar measure for all commodities,[1] the rates of change in purchasing power over the period 1896-1913 may be readily derived. These figures are presented in column (4) of Table 14 and of Table IX.

The relative position of each commodity is, of course, the same as it is with respect to rate of change in actual prices. Rosin, with an average annual rate of increase of 7.7 per cent in purchasing power in the wholesale markets, stands at one extreme, while wood alcohol, with an average annual decrease of 5.6 per cent, stands at the other. The individual figures given in Table IX need no further explanation. Detailed comparison of groups is deferred for treatment in a later volume.

§Rates of Change in the Earnings of American Workers

The methods illustrated above may be applied to advantage in the study of changes in the relative position of different groups of wage-earners. In comparing index numbers of wages the choice of a base period affects all conclusions as to relative changes in the wages received by different groups. If comparison be made in terms of the rate of change over an extended period no such difficulty is encountered. Paul H. Douglas has constructed index numbers of earnings for seven major groups of employed workers and for nine groups of wage-earners in manufacturing plants ("The Movement of Real Wages and Its Economic Significance," *American Economic Review*, Vol. XVI, No. 1, *Supplement*, March, 1926). The average annual rates of change in the earnings of these groups during the period 1896-1913 are given in column (2) of the tables below. (The index numbers for only eight of the manufacturing groups cover this period.) In column (3) of these tables are shown the rates of change in the real wages of these groups. These values have been secured by dividing the rates of increase in money wages by the rate of increase in living costs, using the index of cost of living constructed by Professor Douglas. This index increased at an average annual rate of 1.9 per cent between 1896 and 1913.

The above demonstration relates to the least squares method of fitting, applied to the exponential equation in logarithmic form. In the present study the value of r in the equation $y = ar^x$ has been determined throughout by the use of Glover's mean value table. Within the limits of accuracy of this table the same relationship holds between the r's of the original series, the deflating series and the deflated series.

[1] This is based upon the wholesale price index of the U. S. Bureau of Labor Statistics.

TABLE 15

AVERAGE ANNUAL RATES OF CHANGE IN MONEY EARNINGS AND REAL EARNINGS OF EMPLOYED AMERICAN WORKERS
1896-1913

(1) Group	(2) Rate of increase in money earnings percent	(3) Rate of change in real earnings percent
Government employees	.5	—1.4
Ministers	1.2	— .7
Postal employees	1.3	— .6
Clerical workers, trans. and mfg.	1.4	— .5
Wage earners, mfg.	2.0	.1
Wage earners, trans.	2.0	.1
Teachers	3.9	2.0
All groups	2.4	.5

TABLE 16

AVERAGE ANNUAL RATES OF CHANGE IN MONEY EARNINGS AND REAL EARNINGS OF WORKERS IN MAIN GROUPS OF MANUFACTURING INDUSTRIES
1896-1913

(1) Group	(2) Rate of increase in money earnings percent	(3) Rate of change in real earnings percent
Tobacco products	.8	—1.1
Textiles	1.8	— .1
Iron and steel	1.9	.0
Lumber and its products	1.9	.0
Leather and leather goods	1.9	.0
Paper and printing	2.0	.1
Clothing	2.3	.4
Land vehicles	2.5	.6
All manufacturing	2.0	.1

Of the seven major groups, only three showed an increase in real earnings during the period 1896-1913. Of the eight groups of workers in manufacturing industries, two had declining real wages, three showed neither an upward or a downward tendency, while the real wages of three groups increased.

3. ON "NORMAL" RELATIONS BETWEEN COMMODITY PRICES

The measures shown in Tables 14 and IX bear upon a problem which has received considerable attention in the last several years—

the question as to whether there is a "normal" relation between the prices of commodities and of commodity groups. The difficulties of agricultural producers resulting from the drastic liquidation of 1920 and 1921 gave a very practical emphasis to this question. Efforts to answer it have taken several forms.

One of the most common standards of "normality" derives from the facts that 1913 is the base of most current index numbers, and that 1913 was the last year before war-time disturbances set in. If a given commodity has risen above its 1913 price by less than the average rise in prices, as measured by a general index, it is assumed, in some discussions, that the normal relations of this commodity to other commodities have been disturbed. The re-attainment of a normal relation, from this viewpoint, would involve a decrease in the average of all prices or an increase in the price of the given commodity.

A similar argument may be based upon some base other than 1913. Thus the twelve months, July, 1913 - June, 1914, may be employed. Average prices in a broader base period, such as the five years from 1909 to 1913, may be used in securing a standard. The argument, however, is essentially the same, whether the base be 1890, 1913, 1919, or any combination of years. It is an argument which has been employed in comparing commodity prices and wages, wages and living costs, and other measures, as well as in comparing prices in various commodity groups.

On the basis of the evidence presented in the preceding section it does not appear justifiable to assume that prices in any one year, or that average prices over any period of years, stand in a "normal" relation to each other. There was no normal pre-war relation between prices, in their absolute form. The only normal factor bearing on pre-war price relations (if we mean by normal a situation sustained in a fairly regular fashion over a number of years) was the existence of fairly constant rates of change in individual commodity prices, rates of change which differed materially from commodity to commodity and from group to group. What was constant in the prewar price situation was not a set of fixed price differences but relations which changed at fairly regular rates year by year. Figure 6 furnishes a graphic representation of these shifting relations. To assume that actual prices in a given year stand in a normal relation to each other is to crystalize a cross-section of a constantly changing situation, a procedure which seems equally faulty whether a single year or a number of years be used in computing the basic averages.

But is it possible to set up any standard by means of which price relations may be adjudged "normal" or "abnormal"? This is a problem to which some attention is given below in discussing price stability. It is pointed out that price relations are always changing, and that it is the degree or rapidity of change rather than the degree of departure from any hypothetical state of normality which may be measured. Distinction is made, in that discussion, between short-term and long-term changes in price relations. In considering long-term changes of the type resulting from differences in average annual rates of increase, it is desirable to substitute some other concept for that of normal relations. If we substitute for normal that which is *expected* as a result of past experience we have a more workable and useful concept, and we suggest a problem upon which the present results may throw some light.

When an average annual rate of change in the price of a given commodity has been sustained over a considerable period of years, it is reasonable to assume that this constant annual increment (or decrement) in price comes to be expected by those handling this commodity. The effects of accidental and cyclical forces are, of course, superimposed upon the tendencies due to trend, so that there may be no conscious expectation of a certain annual change. Nevertheless, the fact of a sustained long-term tendency to increase or decrease will have affected the attitudes of manufacturers and dealers, and will be reflected in their business dealings and expectations. Plant extensions, investments in equipment and other long-term commitments by manufacturers will be partially conditioned by these expectations. The land holdings and other investments of agriculturalists will be based upon like expectations. In this case the expectations will relate not only to the prices of specific commodities but to land values which reflect these expected prices.

All these plans and commitments are not, in general, based upon definite expectations of a single commodity's price change, for the profits in business dealings depend upon the relations between prices. A sense of the profit to be expected in handling a given commodity will rest upon a conscious or unconscious appreciation of the price trends of related articles. The manufacturer considers probable future costs of raw materials and supplies, of labor and equipment, as well as the probable future course of selling prices, in making his plans.[1] There thus develops a sense, not of what constitutes a normal relation between commodity prices, but of the alterations in relations which are to be expected in the future. When such expectations are not realized, as in the case of farmers in general in 1921 and succeeding years, there arises the feeling that normal price relations have been shattered. Though the concept of normal relations be illusory, the feeling of disturbance and unsettlement arising from the failure of past tendencies to continue may be a very real one.[2]

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[1] This procedure has become conscious and definite in many organizations, with the development of statistical control and long-range planning. Lines of trend are fitted to

The figures presented in Table IX may be used in determining what were the expectations, in 1913, of those producing and handling the various commodities there listed.[3]

IV Timing, Duration and Amplitude of Individual Price Changes During General Price Movements

During the major cyclical swings of commodity prices there are pronounced differences in the movements of individual commodities, though the general movement may affect all commodities in some degree. A study of these differences may be expected to yield information concerning the price behavior of individual commodities, and should, at the same time, throw some light on the price aspects of business cycles. A detailed investigation of this type, based upon reports concerning quantities and prices from a great many markets, representing important commodities at all industrial stages, should enable the incidence of the business cycle and its propagation throughout the industrial system to be more effectively studied. Such a broad survey must wait, however, upon the compilation of adequate data. The present inquiry is re-

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all relevant price and quantity series, and future plans are based upon careful projections of these trends. As this is but a conscious and more accurate formulation of processes upon which all careful business planning has been based.

[2] The present discussion is confined to the case in which the feeling of unsettlement is an enduring one, as it has been in the field of agriculture in recent years. During every price cycle there are pronounced alterations in relations, exemplified by the case in which the cost of a good may exceed its selling price. But such cyclical disturbances are temporary, quite different in character from the more enduring changes which result from differences in long-term trends. More fundamental economic maladjustments are occasioned by changes of the latter type.

[3] A concept having some relation to that discussed above serves as the foundation of the theory of business cycles developed by Dr. Emanuel H. Vogel. (Die Theorie des volkswirtschaftlichen Entwicklungsprozesses und das Krisenproblem, 1917.) The moving equilibrium between economic processes which is necessary to prosperity is impaired periodically, according to Vogel, because of differences in the rates of growth of the various elements in this equilibrium. (A summary of Vogel's theory is given in Chapter I of Business Cycles, by Wesley C. Mitchell, National Bureau of Economic Research, 1927.) The present inquiry has been confined to rates of change in commodity prices, with merely incidental reference to other economic series. Vogel's theory emphasizes the general economic importance of differences between these rates of change.

stricted to the commodities for which price quotations at wholesale are available, by months, from 1890 to 1926, in the publications of the United States Bureau of Labor Statistics.

1. The Measurement of Cyclical Fluctuations in Commodity Prices

The customary procedure in studying cyclical movements involves the measurement of trend and of seasonal fluctuations, and the correction of the original data for changes due to these factors. The residue, a composite of cyclical and accidental fluctuations, is the material ordinarily used in tracing cyclical movements in time series. This procedure has not been followed in the present study, for several reasons.

Perhaps the most important of these reasons is that we are not trying to measure true "cyclical movements" in commodity prices, though that term is used frequently for convenience. We are seeking to describe the movements of individual prices during the general price swings which have accompanied cycles in American business. The individual price series fail, in many cases, to conform to the general movement. Some may be quite unaffected by given cycles; some may precede or lag behind the general index by such a long period of time as to raise a doubt concerning the connection between their movements and the business cycle. Smooth and unmistakable cyclical movements are conspicuously absent in many of the price series studied. Yet it is none the less desirable to know how the prices of individual commodities behave during the general business cycle. There is need here of a technique better adapted than the orthodox method to the analysis of miscellaneous series.

The presence of technical and practical difficulties connected with the measurement of trend and of seasonal variations provided additional reasons for a modification of the usual procedure. The technical difficulties in the way of securing a complete elimination of the effects of trend and of seasonal movements need not be elaborated. The practical difficulties were connected with the time available and the material to be covered. A prohibitive amount of time would have been required to analyze several hundred series after the orthodox method. The method actually employed has the advantage of permitting a considerable number of series to be analyzed in a limited time and affords, in addition, certain useful measures which the other method does not yield. The procedure adopted requires explanation and illustration.

It is possible to secure measures relating to eight aspects of the behavior of individual commodity prices during each business cycle. Three of these pertain to behavior during the revival and prosperity stages of the cycle, three to behavior during the stages of recession and depression, and two relate to the cycle as a whole. These measures are the following:

Date of low point preceding revival.
Duration of rise during revival and prosperity.
Percentage of rise during revival and prosperity.
Date of high point preceding recession.
Duration of decline during recession and depression.
Percentage of decline during recession and depression.
Duration of cycle.
Amplitude of cyclical movement.

Such measures, relating to specific phases of revival and recession and to specific cycles, enable the characteristics of given cyclical movements to be determined, and permit comparison of different cycles. From these measures, moreover, may be derived figures describing the average behavior of individual commodities.

a. *The Timing of Revival and Recession.* In studying the timing of individual price changes it is necessary to get away from specific dates. This has been done by selecting as reference points the dates of the last low preceding revival and of the last high preceding recession in the general wholesale price index number. Thus the measure defining the time of change in the price of a given commodity in a given stage of revival or recession is the difference, in months, between the date of turn in the general price index and the date of turn in the price of the commodity in question. If the commodity precedes the general index a negative sign is attached to this deviation; if the commodity lags behind the general index a plus sign is used.

The selection of reference points during the period 1900-1925 offered no difficulty, as the index of the Bureau of Labor Statistics is available on a monthly basis for these years. For the period 1890-1899 use was made of Falkner's quarterly index, supplemented by Persons' ten-commodity index when it was necessary to interpolate between quarters. The greatest difference between the turning points shown by Persons' monthly index and by Falkner's quarterly index during this period was two months, and this occurred only once.

During the period 1890-1925 wholesale price index numbers show 21 turning points which may be identified with definite revival or recession phases of ten American business cycles.[1] These cycles were of varying intensity and duration, but it does not seem legitimate, in the light of contemporary records, to exclude any of them from the list. The turning points noted have been numbered from 1 to 21, for convenience of reference. The dates of these reference points are given in column (3) of Table 17. In some instances given values of the index number persisted for several months without change or with only minor fluctuations. In such a case the date given relates to the last observation preceding a distinct turn.

The first task was the study of the individual price series for the purpose of locating in these series the turning points that correspond to the turns in the general price index. For some commodities, which clearly reflect all the major movements in the general index, this was a fairly simple matter. As indicated above, the time of each of the cyclical turns in the specific price series is expressed as a deviation, in months, from the corresponding turn in the wholesale price index. In recording the movements of the individual price series the date given in each case is that of the last low preceding a rise in price, or the last high preceding a price decline. No attempt was made, in locating turning points, to allow for seasonal movements or for trend. The actual low and the actual high which appeared to be identified with given cyclical phases were accepted as the significant turning points for the present purpose.

But many commodities fail to conform in all respects to the scheme of movements outlined in Table 17. Their prices may reflect some of the cycles, but may be quite unaffected by others. The present problem, as has been pointed out, is not essentially that of tracing cycles in individual price series, but that of observing and measuring the behavior of individual commodity prices during the major swings which are found in the general price index. Accordingly, behavior which does not conform to the general movements must be described, as well as that which does so conform.

In a case in which a given series took no turn which could be identified with the prevailing movement in general prices, its behavior could be classified under one of three heads. If, instead of reaching a low and rising, during revival, or reaching a high and declining, during recession, the given price series declined consistently, it was classed as *sagging*. If, instead of experiencing the turn to be expected, the commodity rose in price throughout the prevailing cyclical phase, it was classed as *rising*. If no turn were recorded, the commodity remaining unchanged in price throughout the period in question, the entry *constant* was employed. The latter class contains a subdivision consisting of commodities which were *irregularly constant* in price. This classification was employed when a commodity experienced minor price fluctuations about a constant level during a given period. These fluctuations might be seasonal or accidental; they did not appear to the investigator to be manifestations of the general price swing under way during that period.

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[1] The reference points selected have been checked against the phases of American cycles between 1890 and 1925, as defined by Wesley C. Mitchell and Willard L. Thorp. There is agreement throughout in regard to the cycles marked off.

Each entry in the general table consists, therefore, of a specific figure, or one of the symbols S, R, C or I C. The figure measures the number of months by which the turn in price of the commodity in question preceded (—) or lagged behind (+) the turn in the wholesale price index; the symbol indicates whether the given price series *sagged*, *rose*, or remained *constant* during the period to which the entry refers.

In locating turning points in the prices of the various commodities studied an attempt was made to set limits within which a given rise or decline in price might be expected to fall if it were related to a particular turn in general prices. It did not seem desirable to set any fixed limits on either side of a given reference point, since the duration of price cycles varies considerably. Variable limits were set, therefore, and these limits were so chosen as to include, roughly, three phases of the current cycle (a cycle being assumed to include the four phases, revival, prosperity, recession and depression). Thus the limits to a period in which the low price preceding revival would usually fall were given by the approximate dates of the beginning of the preceding depression and the end of the succeeding phase of prosperity. Similarly, the limits to a period in which the high price preceding recession would be expected to fall were set by the first date of the preceding phase of prosperity and the last date of the ensuing period of depression.[1] The limits which have been employed are given in column (4) of Table 17.

[1] The limits employed are those defined in the previously mentioned summary of the phases of American cycles, prepared by Wesley C. Mitchell and Willard L. Thorp, with a few modifications for the immediate purpose. The only material changes were made in defining the limits to periods 15 and 17, covering the war and post-war years. Some adjustment was necessary here in order to include certain of the exceptional price movements of these years in the periods to which they apparently belonged. In the original summary, it may be noted, phases of the various cycles were defined by overlapping dates.

TABLE 17

DATES OF TURNING POINTS IN AMERICAN PRICE CYCLES, AND LIMITS EMPLOYED IN STUDYING CYCLICAL TURNS IN COMMODITY PRICES

(1) Period	(2) Phase	(3) Reference date	(4) Limits
1	low	May, 1892	Oct., 1890–June, 1893
2	high	February, 1893	Oct., 1891–Feb., 1895
3	low	March, 1895	July, 1893–Jan., 1896
4	high	October, 1895	Mar., 1895–Feb., 1898
5	low	May, 1897	Feb., 1896–Dec., 1899
6	high	April, 1900	Mar., 1898–Mar., 1901
7	low	July, 1901	Jan., 1900–Jan., 1903
8	high	October, 1902	April, 1901–Dec., 1904
9	low	July, 1904	Feb., 1903–Oct., 1907
10	high	October, 1907	Jan., 1905–May, 1909
11	low	February, 1908	Nov., 1907–May, 1910
12	high	April, 1910	June, 1909–Dec., 1911
13	low	June, 1911	June, 1910–Oct., 1913
14	high	September, 1913	Jan., 1912–May, 1915
15	low	November, 1914	Nov., 1913–Aug., 1917
16	high	September, 1918	June, 1915–June, 1919
17	low	February, 1919	Sept., 1917–Sept., 1920
18	high	May, 1920	July, 1919–Mar., 1922
19	low	January, 1922	Oct., 1920–June, 1923
20	high	April, 1923	April, 1922–Dec., 1924
21	low	June, 1924	July, 1923– 1926

Although there are wide divergences from any common pattern in the behavior of individual commodity prices, the above limits include most of the price changes which could be related to particular movements of general prices. For a small number of industrial products and for a somewhat larger number of agricultural products and foods, important price movements fell beyond these limits. Entries relating to such cases are designated in the general table (Table X). For 26 agricultural products and foods the failure to conform to the standard schedule was pronounced, and it was difficult to locate turning points corresponding to the cyclical movements of general business. The names of these exceptional commodities are indicated in the table.

Another problem connected with the construction of the general table arose, in some instances, in determining whether a turning point could be defined or whether a price should be classed as *constant* or *rising* (or *constant* or *sagging*) during a given period. As a rough working rule it was classed as constant if it neither rose nor fell within a period of twelve months on each side of the reference date. But, again, because of varying cycle lengths, there are exceptions to this rule. In general, the entry *constant* means that a price neither rose nor fell during the time when the forces of revival or recession were actively present. Similar general explanations apply to the entries *sagging* and *rising*. After working through a number of price series it was possible to make fairly objective the tests upon which these classifications were based.

It will be obvious to one who looks through the original price quotations that an element of personal judgment must have entered into some of the decisions upon which the entries in the general table are based. A similar analysis of the same data by another person would doubtless yield some differences in detail, but it is not likely that the averages and the general results would differ materially from those secured in this study.

b. *Interpretation of Typical Results.* Table X provides a summary of these results, giving measures descriptive of the behavior of 209 commodities during the 21 turning points listed above. Selected measures from this table, relating to a number of representative commodities, are shown below. Similar figures for seven general economic series are included for purposes of comparison.

This table and Table X present a bird's-eye view of the behavior of a number of commodities during ten cycles in American business. Considerable information is yielded by these tables, whether they be read horizontally or vertically. In studying the behavior of individual commodities a horizontal reading indicates whether the commodity in question was affected by the several major turns in general prices and, if so, the relation in time between the turns of this commodity and the turns in the general index. The prices of anthracite coal, for example, were clearly affected by all the major turns in price during the first seven periods. Following the revival of period 7 (a revival for which the reference date was July, 1901) there were no further cycles in anthracite coal prices. During all other periods of general price change anthracite coal prices were either constant or rising. (For the 13th and 15th periods specific dates appear, since the increase in anthracite coal prices in these periods occurred during phases of revival.) Similarly, steel rail prices reflect all the general movements through the 7th period. These prices were constant thereafter at each major turning point until the general rise following the outbreak of the war. The normal price changes took place during the next four periods, but after the 1922 rise steel rails entered another era of constant prices. Detailed comment on the behavior of other series is not necessary.

A vertical reading of Table 18 (or of Table X) throws light on

TABLE 18

Measures Describing the Behavior of Wholesale Prices of Fifteen Commodities and of Seven General Economic Series during Periods of Revival and Recession in American Business, 1890-1925.

(The figures in the various columns indicate the number of months by which the price turns of specific commodities precede (—) or lag behind (+) the major turns of the gen price index. The symbols I C, C, S and R represent, respectively, irregularly constant, constant, sagging and rising prices. The dates of the reference points are given at the head the several columns.)

Ref. No.	Commodity	Periods																			
		(1) Low (May 1892)	(2) High (Feb. 1893)	(3) Low (Mar. 1895)	(4) High (Oct. 1895)	(5) Low (May 1897)	(6) High (Apr. 1900)	(7) Low (July 1901)	(8) High (Oct. 1902)	(9) Low (July 1904)	(10) High (Oct. 1907)	(11) Low (Feb. 1908)	(12) High (Apr. 1910)	(13) Low (June 1911)	(14) High (Sept. 1913)	(15) Low (Nov. 1914)	(16) High (Sept 1918)	(17) Low (Feb. 1919)	(18) High (May 1920)	(19) Low (Jan. 1922)	(20) High (Apr. 1923)
13	Cattle	+1	0	—10	—6	—12	—6	—15	—2	—12	—3	0	+2	—1	+12	+5	+4	+4	—6	—7	—5
25	Cotton	—2	—2	—1	0	+18	+5	+4	+17	+6	—2	+10	+4	+5	+1	+1	0	0	—1	—10	+8
64	Beef	+1	+6	—12	—6	—13	—7	—4	—3	+16	—2	0	0	+1	+11	+5	—3	+4	+4	0	+8
195	Print cloths	—9	—2	0	0	+12	—3	—1	+17	+10	0	+7	—2	+5	—9	+1	—5	+1	—1	—6	+8
202	Cotton yarns	—12	—6	0	+3	+25	+6	+4	+16	+10	—2	+8	+8	+7	+1	+4	—3	+1	—1	—9	+8
233	Anthracite coal	—3	—4	+6	+13	+8	+10	+9	IC	IC	IC	IC	IC	+1	IC	+13	R	R	R	IC	R
236	Bituminous coal	0	0	—11	+2	+22	—3	+7	+5	+20	+2	※ +32	+11	+24	+3	+21	—15	—16	+7	+3	—7
239	Coke	+7	+1	—10	+16	0	0	—4	+5	10	—8	+8	—6	+5	—8	0	—14	+3	+3	—1	—8
247	Petroleum	+5	+16	—7	—6	+8	—1	—1	+14	+14	+19	S	S	+6	+7	+9	R	R	+7	—5	—1
259	Pig iron	+11	+5	+1	0	+14	—3	+3	+1	0	—9	+6	—3	+8	—8	0	—14	+8	+4	+1	—7
276	Steel billets	+9	+2	—2	—1	0	—6	—9	—4	+3	—5	+17	—1	+6	—5	+1	—14	+8	+2	+2	0
280	Steel rails	—17	—2	+3	+14	+18	+4	—3	C	C	C	C	C	C	C	+18	+5	+10	+6	+8	C
293	Copper, ingot	—2	—1	—9	0	—8	—11	+14	+6	—7	—5	+14	—2	—1	—11	0	—18	+1	—9	—5	0
441	Leather	+9	+12	0	—1	—6	—2	—2	—8	0	—9	※ —7	+2	—4	R	R	—9	—3	—9	+4	+3
451	Rubber	—8	0	—7	+1	—15	0	+13	R	R	—28	+1	+1	+1	—17	0	0	+4	—6	+2	—2
	Index of wholesale prices (U. S. B. of L. S.)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Index of general business conditions (A. T. & T.)	—12	+1	—9	0	—7	—2	—7	—1	—7	—3	+4	—1	—2	—8	+1	—1	+1	—4	—6	+1
	Index of industrial stock prices (Dow-Jones)	—17	—1	—19	—4	—9	—7	—10	—16	—8	—21	—3	—5	—11	—11	+1	—22	—14	—7	—5	—[illegible]
	Discount rate on 60-90 day commercial paper	+1	+5	+3	+12	—3	—4	—5	+11	0	+2	+16	+6	—1	—2	+12	+1	0	+5	+7	+5
	Interest rate on call loans	+1	+4	—5	+12	+2	—4	—11	—1	+1	0	+6	—4	—10	—9	+10	+1	+1	—6	+7	—1
	Yield on fifteen railroad bonds	+1	+6	+6	+10	+25	—4	+10	+10	+13	+1	+15	+4	+8	+24	+26	0	—3	0	+7	—1
	Pig iron production	—13	—11	—9	+2	—7	—2	—8	+7	—7	0	—1	—4	—5	—4	+1	+1	+8	+5	—6	+1

※ Entries relating to turning points beyond the limits defined in Table 17.

the order of change in various price series during the several periods of revival and recession between 1890 and 1925. For the first period, the revival of the early 90's, the dates of recovery for the fifteen commodities shown in Table 18 range from 17 months before the reference date to 11 months after that date. The corresponding limits in the general table, covering 209 commodities, are 18 months before the reference date to 17 months after the basic turning point. These limits vary considerably for the different cycles, but this is a matter for more detailed consideration in the sections dealing with prices in combination.

In studying the characteristics of individual commodities it is necessary to present these results in another form. In doing so, use can be made of other measures not shown in the above summary. The procedure followed in the analysis of an individual commodity may be exemplified by pig iron, the prices of which reflect all the cyclical movements of general business during the years from 1890 to 1925. A summary such as the following was compiled for each of 209 commodities.[1]

TABLE 19

SUMMARY OF CYCLICAL MOVEMENTS IN THE PRICES OF PIG IRON*

1890-1925

(1) Periods	(2) Deviation of *low* from reference date (mos.)	(3) Deviation of *high* from reference date (mos.)	(4) Duration of rise (mos.)	(5) Duration of fall (mos.)	(6) Duration of cycle (low to low) (mos.)	(7) Percentage change: Rise as percentage of preceding low	(8) Percentage change: Rise as percentage of ensuing high	(9) Percentage change: Fall as percentage of preceding high	(10) Index of cyclical variability $\frac{(8) + (9)}{2}$
1- 2	+11	+ 5	3	21	24	2.9	2.8	20.0	11.4
3- 4	+ 1	0	6	33	39	20.8	17.2	22.4	19.8
5- 6	+14	— 3	18	21	39	122.2	55.0	38.0	46.5
7- 8	+ 3	+ 1	13	20	33	60.5	37.7	39.9	38.8
9–10	0	— 9	30	19	49	84.1	45.7	38.2	41.9
11–12	+ 6	— 3	17	25	42	14.7	12.8	21.3	17.0
13–14	+ 8	— 8	11	22	33	23.8	19.2	23.7	21.4
15–16	0	—14	32	27	59	320.7	76.2	51.0	63.6
17–18	+ 8	+ 4	11	17	28	88.4	46.9	63.4	55.1
19–20	+ 1	— 7	7	25	32	83.8	45.6	41.8	43.7
21	+ 4								
Averages	+5.1	—3.4†	14.8	23.0	37.8	82.2	35.9	36.0	35.9

*Foundry No. 1, 1890-1913; basic, 1914-1925.

†This average becomes —2.2 if the price turn due to war-time regulation (the entry for period 16) be omitted.

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[1] Space limitations prevent the inclusion of detailed figures, of the type shown in Table 19, for all the commodities analyzed. In Table XI, of the Appendix, such figures are given for a selected list of 24 important commodities.

The method of entering the various measures given in this table requires some explanation. The entries on each line relate to the two periods the numbers of which appear in the first column, and to the interval between these periods and the interval immediately following. Thus, considering the entries in the first line, the figure in column (2) shows that the low of pig iron prices in the first period came 11 months after the low of the all-commodities index. From column (3) we read that the high of the second period came 5 months after the high of all commodities. The entry in column (4) shows that the rise in prices following the low of the first period lasted for 3 months before the next high was attained.[1] The entry in column (5) indicates that the decline in pig iron prices following the high of the second period lasted for 21 months. The duration of the cycle[2] in pig iron prices between the low of the first period and the next succeeding low (that of the third period) is shown in the first line of column (6). This entry measures the combined duration of a period of rising prices and the ensuing period of falling prices.

The average of the entries in columns (8) and (9) has been used as an *index of cyclical variability*. This appears in column (10). The two percentages which are averaged in each case are computed from the same base and are, therefore, perfectly comparable. Moreover, the different entries in column (10), which relate to different cycles, may be compared in determining whether the violence of the cyclical fluctuations in a given series is increasing or decreasing. Each entry is a percentage computed from the "high" of a given cycle; cyclical variability is expressed in terms of the maximum values attained in successive cycles. The effect of a consistent upward or downward trend is thus eliminated. In securing an index of the average cyclical variability of a particular series the figures measuring the mean percentage of rise and the mean percentage of fall have been averaged.[1]

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[1] This particular entry suggests one of the difficulties of this general type of analysis, and serves to illustrate the procedure employed. It may seem questionable whether account should be taken of a 2.9 per cent rise in price which lasted for but 3 months. This can hardly be called a phase of a cycle. But, on the other hand there was a distinct revival in American business during this period. The American Telephone and Telegraph Company's composite index shows a gain of about 20 per cent from the low point. Falkner's index (supplemented by Persons' in defining turning points) rose for 9 months, the increase being slightly over 3 per cent. During this period pig iron prices sagged, in general, the decline being broken only by the 3 months rise, of 2.9 per cent, which is recorded above. There is no evidence that this rise was seasonal in character. It was a reflection of the general revival taking place at this time and, brief though it was, account should be taken of it in any study of those movements of individual commodity prices which accompany cyclical movements of general business and of general wholesale prices. It is, of course, exceptional that the movement should be so brief. The other pig iron price movements recorded are all of much longer duration.

[2] The term "cycle" is used for convenience in referring to these movements. Since the given measures relate to price movements accompanying cycles in general business there is justification for using this term, but in some ways it is misleading. Thus, if a commodity rose steadily in price, or remained constant, for a number of years, unaffected by several successive business cycles, the duration of the "cycle" might be given as 100 months, or more. Such a long movement does not accord with the usual definition of the term.

During the ten cycles covered in this study the general trend of the index of cyclical variability in pig iron prices has been upward. The upward movement has itself been cyclical in character, however. During the first two cycles (culminating in 1893 and 1895) the variability was low. A much higher figure was recorded for the cycles which reached their peaks between 1900 and 1907. Between 1907 and the war period the variability of pig iron prices was much lower. During the last three cycles wide fluctuations have again been recorded.

For convenience of reference the various averages computed from figures in Table 19 may be summarized in a table of the type shown on the opposite page. Measures describing the behavior of the general index of wholesale prices are included, for comparison with the pig iron figures.

During revival the price of this particular grade of pig iron has started upward, on the average, 5.1 months after general wholesale prices. The entire period of rising prices has lasted, on the average, 14.8 months, as compared with 23.4 months for the wholesale price index. The average percentage of rise has been 82.2, as compared with 24.6 for the general index. (When the rise is computed as a percentage of the high, the pig iron figure is 35.9 as compared with 16.7 for the price index.) In interpreting these figures it must be recalled that no attempt has been made to eliminate the effects of the upward trend of prices from 1896 to 1920. In so far as this trend affects the comparison of the upward and downward swings it is taken account of by expressing each rise as a percentage of the ensuing high value.

During recession pig iron prices have started downward, on the average, 3.4 months before general prices. (This figure is reduced to 2.2 if the exceptional period of price regulation be omitted from the calculations.) The difference of approximately eight and one-half months between the duration of rise of general prices and of pig

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[1] The use of the "high" in each cycle as the base of the percentages which are averaged in securing an index of cyclical variability, instead of an average of low and high values, lessens slightly the relative weight given to wide cyclical fluctuations, as compared with smaller movements.

TABLE 20

TIMING DURATION AND AMPLITUDE OF CYCLICAL MOVEMENTS IN AN INDEX NUMBER OF WHOLESALE PRICES AND IN PIG IRON PRICES, 1890-1925.

(The month is the unit in all measures relating to time)

(1) Price series	(2) No. of cycles observed	(3) Behavior during revival	(4)	(5)	(6) Behavior during recession	(7)	(8)	(9) Average duration of cycle, low to low (mos.)	(10) Average percentage of	(11)	(12) Index of cyclical variability Average of cols. (10) and (11)
		Average deviation from reference date (mos.)	Average duration of rise (mos.)	Average percentage of rise (based on preceding low value)	Average deviation from reference date (mos.)	Average duration of fall (mos.)	Average percentage of fall (based on preceding high value)		rise (based on ensuing high value)	fall (based on preceding high value)	
Wholesale price index[1]	10	0	23.4	24.6	0	15.1	11.8	38.5	16.7	11.8	14.2
Pig iron prices	10	+5.1	14.8	82.2	−3.4[2]	23.0	36.0	37.8	35.9	36.0	35.9

[1] The measures for this series are based upon Falkner's index, from 1890 to 1899, and upon the index of the U. S. Bureau of Labor Statistics, from 1900 to 1925.

[2] This average becomes −2.2 if the price turn due to war-time regulation be omitted.

iron prices is thus accounted for by a lag of pig iron of roughly 5 months on recovery and a lead of some 3 months on recession. That these averages relating to the lag and lead of pig iron are representative is clear from a consideration of the individual measures in Table 19. Not once in 11 revivals has pig iron started upward before the general index. Only 3 times in the 10 recessions recorded have pig iron prices started downward after the general index.

The average duration of decline of pig iron prices has been 23.0 months, as compared with 15.1 for the general index. The cyclical swings of pig iron prices include a sharp and relatively brief upward movement and a downward movement lasting, on the average, half as long again. During only 2 of the 10 cycles included in this study has the duration of the upward movement exceeded the duration of the ensuing decline. In this respect pig iron prices stand in pronounced contrast with the general wholesale price index. For this index the duration of rise is equal, on the average, to about one and one-half times the duration of fall. Only twice in the 10 cycles recorded has the duration of rise for the general index been less than the duration of the ensuing fall. The percentage of decline has averaged 36.0 for the pig iron, as compared with 11.8 for the wholesale price index.

The indexes of cyclical variability, constructed by averaging the percentages of rise and fall (both rise and fall being expressed as percentages of the same high), appear in column (12). This index is 35.9 for pig iron, and 14.2 for the wholesale price index. The price of pig iron is about two and one-half times as variable, in its cyclical movements, as the general price index.

The average duration of the cycle is slightly less for pig iron prices than for the wholesale price index. This is a somewhat accidental result, in the present instance, for every cycle in general prices during the period 1890-1925 was reflected in pig iron prices. This fact should result in approximate equality of the two averages. The difference is due to the relatively late revival of pig iron in the first period.

In making the above comparison use has been made, in every instance, of pig iron averages based upon all the data, including those for the period of war-time regulation. The only average materially affected by regulation is that relating to the date of the turn downward from a high. The average of —2.2 secured by omitting the entry for the regulated period is probably more representative than that of —3.4 which is based upon all the entries. In all other respects it seems desirable to include all the data, since all the periods have been included in securing the price index averages.

Considerable space has been given to this comparison in order to illustrate in some detail how the measures in the general table (XII) are to be interpreted. It is, of course, out of the question to include similar discussions of the measures for other commodities.

In the above illustration use was made of a commodity which offered few difficulties to analysis of this type, since all the cycles between 1890 and 1925 are defined in the movements of pig iron prices. A few modifications of the method are necessary in handling commodities which do not follow all the cyclical movements of the general index. These modifications are enumerated in the following section.

§The Measurement of Cyclical Price Movements: Special Cases

(1) In measuring the duration of a rise the whole time between a turn upward from a low and the next succeeding turn downward from a high is counted, whether the rise extends over one or more cycles in general business. The same principle applies in measuring the duration of a price decline.

(2) In measuring the duration of a cycle the full time elapsing between a specific low entry and the next specific low entry is counted, regardless of intervening periods of constant, sagging or rising prices. A price cycle for a given commodity might thus cover several of the cycles marked out by the general price index. The same principle applies in counting the number of observed cycles. (In the computation of the averages given in Table 33, however, account has been taken only of "normal" cycles, i. e., movements corresponding to specific cycles in general business.)

(3) In measuring the average deviation of the time of recession from the reference dates, two averages have been secured for each commodity. The first average in each case is based upon all the entries, the second upon all the entries but that for period 16 (the period of recession for which the reference date is September, 1918). This second average (given in Table XII) is not affected by price regulation during the war, nor by other unusual factors connected with the war-time disturbances.

A second average for the timing of revival has been computed for each of four articles, for which price regulation extended into period 17 (the period of revival for which the reference date is February, 1919). The entry for period 17 has been omitted in computing the second average in each of these cases.

(4) In computing the average time of revival or recession as a deviation from the reference date, account is taken only of the actual turns observed. Thus an entry of C, S or R is disregarded in arriving at these

averages. The number of turns observed is noted, however, in connection with each average.

(5) In computing the average duration of rise, in cases where entries of C, S or R have intervened between specific dates, two averages have been secured. The first is based upon all the duration figures, including those (mentioned in point 1 above) which may extend through one or more cycles. The second average is based only upon those entries relating to adjoining periods. In this last computation periods of rise covering more than one "normal" cycle are excluded.

Second averages have been computed on the same principle in measuring the duration of fall, the duration of cycles, the percentage of rise and fall, and the amplitude of cyclical movements.

2. Cycles in Commodity Prices: General Measures

Measures relating to 209 commodities have been computed according to the above rules, and are summarized in Appendix Table XII. An extract from this general table appears in Table 21 below. In addition to the commodity price averages there are included in this table measures describing the cyclical movements of seven other economic series. A first inspection of these other measures may make clearer the significance of the commodity price averages.

All the series relating to data other than specific commodity prices reflect each of the ten cycles in American business which occurred between 1890 and 1925. Of these seven series the earliest to revive after depression, on the average, was the index of industrial stock prices which started upward 9.4 months before general wholesale prices recovered. Next came pig iron production, 4.2 months before the price index, and the American Telephone and Telegraph Company index of general business conditions, with an average movement just 4 months before wholesale prices. The interest rate on call loans lagged .4 of a month after the price index on revival, the rate on 60-90 day paper 3.1 months, and the yield on railroad bonds 10.9 months. (The figure for bond *prices* would, of course, represent movements just reversing those of bond *yields*.)

Some of these averages are changed rather materially for the recession phase of the cycle. The stock price index precedes the wholesale price index by about the same interval (9.5 months). The lead of pig iron production is reduced from 4.2 months to .5 of a month, and that of the general business index from 4 months to 1.8 months. The lag of .4 of a month for call loan rates is changed to a lead of .8 of a month on recession; the lag of 3.1 months for the 60-90 day paper rate, is changed to a lag of 4.1 months; the lag of 10.9 months on railroad bond yields is changed to a lag of 5.0 months. These figures indicate that the sequence of change in different economic series is in many cases not the same at the recession phase of the cycle as it is during the stage of revival. A measure of average lag or lead which does not discriminate between different cyclical phases may be quite inaccurate.

The average duration of rise for these seven series varies from 17.6 months for bond yields to 27.6 months for pig iron production. These extremes are reversed in the duration of fall column. Pig iron production, with a figure of 12.3 months, has the shortest average time of fall, while bond yields, with an average of 22 months, have the longest. With the single exception of bond yields the duration of rise exceeds the duration of fall. (Bond *prices* would conform to the other series in this respect.) For these general economic series the typical cyclical movement during the period between 1890 and 1925 has consisted of a rise averaging about two years, and a decline averaging from 12 to 16 months. The average cycle length has been a trifle less than 40 months.

The degree of cyclical variability, as measured by the indexes given in column (21), ranges from 11.2 for bond yields to 75.0 for call loan rates. The variability of the price index is relatively low, as is also that of the general business index. Industrial stocks, commercial paper rates and pig iron production stand on a rising scale of variability.

In interpreting the entries in the table below relating to commodity prices, it should be remembered that the second average in column (14) has been computed, in each case, by excluding the entry for period 16, which covers the time of war inflation and price regulation. Where a second entry appears in other columns it relates to figures for successive cyclical turns. As explained in note 5 on page 90 such averages were computed for commodities which did not reflect, in their price movements, all the cycles which affected general business between 1890 and 1925.

a. *Number of Price Cycles Recorded.* The information to be obtained from Table XII, in the Appendix, and from Table 21, may be most clearly presented by summarizing the figures in several supplementary tables, in which the commodities are arranged in order of magnitude of the various types of averages. The first question of interest relates to the number of cycles observable in the prices of the different commodities studied. The fifteen com-

TABLE 21

MEASURES DESCRIBING THE BEHAVIOR OF WHOLESALE PRICES OF FIFTEEN COMMODITIES AND OF SEVEN GENERAL ECONOMIC SERIES DURING PERIODS OF REVIVAL AND RECESSION IN AMERICAN BUSINESS, 1890-1925

Averages relating to Timing, Duration and Amplitude of Cyclical Movements[1]

(1) Ref. No.	(2) Commodity	(3) No. of cycles observed	(4) Behavior during revival	(5)	(6)	(7)	(8)	(9)	(10) Behavior during recession	(11)	(12)	(13)	(14)	(15)	(16) Average duration of	(17)	(18)	(19) Av. percentage of	(20)	(21) Index of cyclical variability
			Constant	Sagging	Rising	Turns observed	Av. time as a deviation in months from the reference date	Av. percentage of rise based on preceding low value	Constant	Sagging	Rising	Turns observed	Av. time as a deviation in months from the reference date	Av. percentage of fall based on preceding high value	Rise in mos.	Fall in mos.	Cycle in mos.	Rise (based on ensuing high value)	Fall (based on preceding high value)	
13	Cattle	10				11	− 5.5	52.0				10	− 1.0 − .5	26.7	27.1	9.9	37.0	32.0	26.7	29.3
25	Cotton	9½		1		10	+ 3.2	114.7				10	+ 3.0 + 3.3	42.2	23.2	16.5	38.7	47.3	42.2	44.7
64	Beef	10				11	+ .3	46.6				10	+ .8 + 1.2	25.3	24.4	14.5	38.9	30.2	25.3	27.7
195	Print cloths	9½		1		10	+ 2.0	108.7				10	+ .3 + .9	42.0	21.7	19.0	39.9	43.5	42.0	42.7
202	Cotton yarns	9½		1		10	+ 3.8	82.9				10	+ 3.0 + 3.7	34.8	22.6	18.3	39.9	36.8	34.8	35.8
233	Anthracite coal	3	4		1	6	+ 5.7	39.7	4		3	3	+ 6.3 + 6.3	22.5	19.7	21.0	40.7	28.3	22.5	25.4
236	Bituminous coal	9½	1			10	+10.2 +13.1	59.4				10	+ .5 + 2.2	27.5	13.7	25.2	39.9	31.2	27.5	29.3
239	Coke	10				11	+ .8	215.2				10	− 1.9 − .5	58.2	20.7	17.2	37.9	58.2	58.2	58.2
247	Petroleum	8		1	1	9	+ 2.4	124.4 91.9		1	1	8	+ 6.9 + 6.9	39.9 41.8	29.9 25.0	16.7 14.7	46.6 37.7	50.1 46.2	39.9 41.8	45.0 44.0
259	Pig iron	10				11	+ 5.1	82.2				10	− 3.4 − 2.2	36.0	14.8	23.0	37.8	35.9	36.0	35.9
276	Steel billets	10				11	+ 3.6	103.2				10	− 3.2 − 2.0	40.2	16.7	21.4	38.1	40.1	40.2	40.1

280	Steel rails	5	4			7	+ 5.3	45.7 32.5	5			5	+ 5.2 + 5.5	26.7 26.7	57.6 18.5	18.6 18.6	76.2 39.2	25.3 19.8	26.7 26.7	26.0 23.2
293	Copper, ingot	10				11	— .2	65.0				10	— 5.1 — 3.7	33.2	18.6	20.2	38.8	33.6	33.2	33.4
441	Leather	9			1	10	— .8	33.0 22.0			1	9	— 2.3 — 1.5	19.8 19.8	26.2 19.2	15.7 15.7	41.9 35.5	21.4 17.3	19.8 19.8	20.6 18.5
451	Rubber	9			1	10	— .9	67.8 64.4			1	9	— 5.7 — 6.4	41.0 41.0	23.7 22.4	20.0 20.0	43.7 40.7	31.5 29.3	41.0 41.0	36.2 35.1
	Index of wholesale prices (U. S. B. of L. S.)	0				11	0	24.6				10	0 0	11.8	23.4	15.1	38.5	16.7	11.8	14.2
	Index of general business conditions (A. T. & T.)	10				11	— 4.0	29.4				10	— 1.8 — 1.9	23.0	26.0	13.7	39.7	22.1	23.0	22.6
	Index of industrial stock prices (Dow-Jones)	10				11	— 9.4	67.6				10	— 9.5 — 8.1	32.8	23.4	16.0	39.4	38.1	32.8	35.4
	Discount rate on 60-90 day commercial paper	10				11	+ 3.1	106.6				10	+ 4.1 + 4.4	46.5	24.5	14.3	38.8	47.3	46.5	46.9
	Interest rate on call loans	10				11	+ .4	644.6				10	— .8 — 1.0	74.2	22.4	16.2	38.6	75.9	74.2	75.0
	Yield on fifteen railroad bonds	10				11	+10.9	13.0				10	+ 5.0 + 5.5	11.3	17.6	22.0	39.6	11.2	11.3	11.2
	Pig iron production	10				11	— 4.2	153.3				10	— .5 — .5	50.6	27.6	12.3	39.9	56.5	50.6	53.5

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[1] For an explanation of the second entries in certain columns, see points (3) and (5) on pp. 89-90.

modities used for illustrative purposes are ranked below, in the order set by these measures.

TABLE 22

RANKING OF FIFTEEN COMMODITIES ACCORDING TO THE NUMBER OF CYCLES OBSERVABLE IN THEIR PRICE MOVEMENTS, 1890-1925

(1) Ref. No.	(2) Commodity	(3) No. of cycles
233	Anthracite coal	3
280	Steel rails	5
247	Petroleum	8
441	Leather	9
451	Rubber	9
236	Bituminous coal	9½
25	Cotton	9½
202	Cotton yarns	9½
195	Print cloths	9½
64	Beef	10
13	Cattle	10
239	Coke	10
293	Copper, ingot	10
259	Pig iron	10
276	Steel billets	10

Table XII, in which appear figures of this type for all commodities, shows a wide range of variation in the number of cycles recorded. At one extreme stand three commodities (cross-cut saws, hand saws and trowels) which passed through but one complete price cycle between 1890 and 1925. During most of this period these articles were constant in price. The one complete cycle in their prices began with the low preceding the war-time rise, attained its peak in 1921, and reached a new low in 1922 (for trowels, in 1923). Of the 209 commodities studied, 53 reflected in their price movements all the cycles between 1890 and 1925—10 in number. Many articles were not affected by the minor cycles, but more than two-thirds of the total number passed through 7 or more complete cycles. The sensitivity to cyclical movement, it is apparent, varies greatly as between the different commodity groups. This is a matter for more detailed consideration in a later study.

b. *The Duration of Cycles in Commodity Prices.* Figures relating to another phase of price behavior are summarized in the next table. Here the fifteen representative commodities are arranged in order, according to the average duration of the cycle.

(In computing these averages the duration of the cycle was measured from low to low, in all cases.)

TABLE 23

RANKING OF FIFTEEN COMMODITIES ACCORDING TO THE AVERAGE DURATION OF PRICE CYCLES, 1890-1925

(1) Ref. No.	(2) Commodity	(3) Average duration of cycle, in months
13	Cattle	37.0
259	Pig iron	37.8
239	Coke	37.9
276	Steel billets	38.1
25	Cotton	38.7
293	Copper, ingot	38.8
64	Beef	38.9
236	Bituminous coal	39.9
202	Cotton yarns	39.9
195	Print cloths	39.9
233	Anthracite coal	40.7
441	Leather	41.9 (35.5)
451	Rubber	43.7 (40.7)
247	Petroleum	46.6 (37.7)
280	Steel rails	76.2 (39.2)

A warning should perhaps be voiced concerning the conclusions to be drawn from these figures. What constitutes a cycle in a time series may be a debatable point, in many cases. Ten cycles were distinguished in the movements of the general price index between the low of 1892 and the low of 1924. As far as possible the individual price series were fitted into the framework set by the changes in the general index. There was a clear tendency in the method, in other words, to place upon individual series the impress of the general price cycles. There seems to be no doubt, as an objective fact, that these general cycles are reflected in the movements of a great majority of the individual price series, and that the equality of most of the averages relating to cycle duration is due to the presence of common cyclical movements. It is probable, however, that the use of a common framework is to some extent responsible for the rough equality of the averages, which cluster in the neighborhood of 40 months. The only great departures from the general average occur when given commodities fail to reflect some of the major price cycles.

In cases where the average cycle length has been affected by missed periods, (i. e., by the failure of the commodity to reflect the successive cyclical turns in general prices) a second average, which appears in parentheses after the main entry, has been computed. This is based only upon entries relating to successive periods of revival and recession. Thus the steel rail average of 76.2 months becomes 39.2 months if we take account only of the cycles which were completed without missed phases intervening.

Table XIII, in the Appendix, shows the average cycle lengths for all the commodities studied. The commodities are arranged by groups, and in order of magnitude of the averages within the several groups. The smallest average recorded is 36.8 months, for one grade of muslin. Most of the commodities which passed through all ten cycles have averages not greatly in excess of this figure. The largest figure is 279 months, for kitchen tables, a commodity which passed through but one cycle during the period here studied.

For the seven general economic series listed in Table 21 the average duration of the cycle varied from 38.5 months to 39.9 months.

c. *Cyclical Variability of Commodity Prices.* Individual differences between commodities are more marked in the matter of cyclical variability of prices than they are in respect to duration of price cycles. The following table shows these differences for the fifteen commodities which have been used for illustrative purposes.

TABLE 24

RANKING OF FIFTEEN COMMODITIES ACCORDING TO THE CYCLICAL VARIABILITY OF THEIR PRICES, 1890-1925

(1) Ref. No.	(2) Commodity	(3) Index of cyclical variability
441	Leather	20.6 (18.5)
233	Anthracite coal	25.4
280	Steel rails	26.0 (23.2)
64	Beef	27.7
236	Bituminous coal	29.3
13	Cattle	29.3
293	Copper, ingot	33.4
202	Cotton yarns	35.8
259	Pig iron	35.9
451	Rubber	36.2 (35.1)
276	Steel billets	40.1
195	Print cloths	42.7
25	Cotton	44.7
247	Petroleum	45.0 (44.0)
239	Coke	58.2

In interpreting these figures the number of cyclical movements upon which they are based should be borne in mind. These are given in Table 22. That the measures of cyclical variability are not to be considered perfect indexes of the sensitivity of the different commodities to general cyclical movements is brought out by a comparison of the pig iron and petroleum figures. The index of variability for pig iron is 35.9; that for petroleum is 45.0. The former commodity passed through ten complete cyclical movements, the latter through only eight. The range of price variation during the average cycle was greater for petroleum prices, but this commodity sagged throughout one whole cycle and rose throughout another.

Corresponding measures relating to certain general economic series are given in Table 21. The variability of pig iron prices, with an index of 35.9 is distinctly less, it may be noted, than the variability of pig iron production, for which the index is 53.5.

All the commodities studied are arranged by groups in Appendix Table XIV, in order of magnitude of the indexes of cyclical variability. The range of these indexes extends from 12.8 for shovels and grain alcohol to 77.4 for onions, but the great bulk of the entries fall between 15 and 45. There are notable differences between the values found in the different commodity groups.

In computing the averages upon which the commodities are ranked in Table XIV, all percentages of rise and percentages of fall between cyclical turning points have been included, whether the period of rise or fall extended over one complete cycle or more. In most cases such an average serves as a representative measure of the cyclical variability of a commodity, but in a few instances it does not. If a commodity rose from 1897 to 1920, and then fell to a low in 1922, the latter change might well be considered a true cyclical movement, but the former could not. A second average, based only upon percentages of rise and fall relating to successive phases of individual cycles, appears in parentheses after some of the entries in Table XIV and in Table 24. In cases where the two differ materially the second may be accepted as more representative than the first.

3. Behavior of Commodity Prices During Revival

The three preceding tables have dealt with measures relating to the cycle as a whole. Certain of the figures given in the general tables relate to the behavior of commodities during specific phases of the cycle. Attention may first be given to the phase of revival.

a. *Degree of Conformity to General Price Movements during Revival.* During the period between 1890 and 1925 there were eleven fairly pronounced revivals in American business. The entries in column (7) of Appendix Table XII indicate the number of definite price revivals recorded for specific commodities. A ranking of commodities according to the number of revivals observed would be much the same as a ranking based on the total number of cycles through which given commodities passed. The same would be true of a ranking based upon the entries in column (13) of Table XII, showing the number of price recessions recorded. There are a few noteworthy differences, however. Anthracite coal, which reflected 3 of the 10 cycles, shared in 6 of the 11 upward price movements between 1890 and 1925. It moved downward in price during but 3 of the 10 down-turns in general prices. Similarly, steel rails moved upward during 7 of the 11 general upward movements and downward during but 5 of the 10 recessions. A few of the more stable commodities display a certain responsiveness to a general upward movement in prices, but are somewhat less sensitive to the forces of recession.

Considerable light is thrown upon the characteristics of different price series by a study of their behavior at such times as they did not share in general price revivals. This may have been because prices were *constant* during revival, *sagging* during revival or because the price of a given commodity continued during revival a general upward course which had prevailed during the preceding period of depression. In such a case it is tabulated as *rising.*

Only a few of the fifteen commodities which have been used in illustrating the results failed to conform in general to the cyclical swings of the wholesale price index. Three of these articles were constant in price during general price revivals. These were bituminous coal (constant during one period of revival), anthracite coal and steel rails (each constant during 4 of the 11 general revivals). Four articles from this list, cotton, print cloths, cotton yarns and petroleum, sagged in price during 1 of the 11 revivals. Four commodities, anthracite coal, petroleum, leather and rubber, are recorded as rising during a period of price revival (i. e. the prices of these articles did not follow the general course in showing a turn upward from a low, at revival, but continued a rise which had prevailed during the preceding period of depression.)

Information of this type for all the commodities studied may be had from Table XII. We have data relating to 209 commodities during 11 price revivals, making 2299 entries in all. These entries fall in the classes shown below.

TABLE 25

BEHAVIOR OF ALL COMMODITIES DURING PRICE REVIVALS

(1) Nature of entry	(2) No. of entries	(3) Percentage of total
Specific date (for beginning of revival)	1830	79.6
Constant	239	10.4
Sagging	121	5.3
Rising	109	4.7
Total	2299	100.0

This table indicates that in approximately 80 per cent of all cases the prices of individual commodities showed an increase during revival which could be associated with the general movement. In about 10 per cent of all cases prices were constant, in about 5 per cent sagging and in about 5 per cent rising. These figures relate to a specific era in a single country. Within this era and country periods of price revival have differed materially in their pervasiveness, and we should expect the percentages relating to constant, sagging and rising entries to vary somewhat from cycle to cycle. The figures for the separate cycles are discussed in Chapter IV.

b. *Sequence of Change in Commodity Prices during Revival.* In comparing the figures showing the order of price revival it must be recalled that we are dealing here only with averages, and that these averages should be supported by evidence as to the consistency of the movements they represent. Such evidence is provided by the figures in column (5) of Table 26. These are the standard deviations of the original figures which measure the differences, in months, between the dates of revival in the general price index and the dates of revival in the prices of the commodities named. The measure would, of course, be zero if this difference were constant, that is, if the time relation between general price movements and movements in the price of a given commodity were unvarying. Since higher values mean less consistency in the behavior of the original prices, the figures may be called measures of inconsistency.[1]

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[1] The measure of inconsistency is expressed in months, just as is the average deviation from the reference point. In comparing the measure of inconsistency with this

The measure of inconsistency, it should be noted, is based upon entries for periods during which prices rose. If prices were constant, sagging or rising during certain periods of revival, no account was taken of such entries. A perfect measure of consistency should take account of such failures to conform to the general movement. Because the present measure does not include such periods of nonconformity it should be interpreted in connection with the entries in column (7) of Table 21 showing the number of periods of general revival during which price up-turns were recorded for specific commodities.

The average sequence of price change during revival for the fifteen representative commodities is shown in the following table, together with the measures of inconsistency.

TABLE 26

SEQUENCE OF REVIVAL IN SELECTED WHOLESALE PRICE SERIES, WITH MEASURES OF INCONSISTENCY

Ranking of Fifteen Commodities according to the Timing of Price Revival, 1890-1925

(The figures in column (4) measure deviations, in months, from the date when the general index of wholesale commodity prices reached its lowest point, preceding revival. The sign (—) indicates a price recovery *preceding* that in general prices; the sign (+) indicates a price recovery *lagging behind* the revival of general prices.)

(1) Ref. No.	(2) Commodity	(3) No. of price revivals	(4) Average deviation from reference date (in months)	(5) Measure of inconsistency
13	Cattle	11	— 5.5	7.2
451	Rubber	10	— .9	7.2
441	Leather	10	— .8	4.5
293	Copper, ingot	11	— .2	7.5
64	Beef	11	+ .3	7.7
239	Coke	11	+ .8	4.8
195	Print cloths	10	+ 2.0	6.3
247	Petroleum	9	+ 2.4	7.3
25	Cotton	10	+ 3.2	7.2
276	Steel billets	11	+ 3.6	6.4
202	Cotton yarns	10	+ 3.8	9.7
259	Pig iron	11	+ 5.1	4.5
280	Steel rails	7	+ 5.3	11.5
233	Anthracite coal	6	+ 5.7	5.2
236	Bituminous coal	10	+13.1[1]	13.2

[1] Excluding period 17.

average, it must be borne in mind that the reference point in each cycle has been arbitrarily selected. A date other than the turning point in the wholesale price index would have been just as satisfactory, for the general purpose of the present study. Accordingly, the significance of the average is not dependent upon its relation to the measure of inconsistency, although the consistency of the lag or lead of a particular commodity in reference to the general price index may be so determined.

The figures in the following table, relating to seven general economic series, may be compared with those given above.

TABLE 27

SEQUENCE OF REVIVAL IN SEVEN ECONOMIC SERIES, WITH MEASURES OF INCONSISTENCY

(1) Series	(2) Average deviation from reference date (in months)	(3) Measure of inconsistency
Index of industrial stock prices (Dow-Jones)[1]	— 9.4	5.5
Pig iron production	— 4.2	5.6
Index of general business conditions (A. T. & T.)	— 4.0	4.8
Index of wholesale prices (U. S. B. of L. S.)	0.0	0.0
Interest rate on call loans	+ .4	6.3
Discount rate on 60-90 day commercial paper	+ 3.1	6.1
Yield on fifteen railroad bonds	+10.5	8.5

[1] The average deviation from the reference date for Macaulay's index of railroad stock prices is −7.7, with a measure of inconsistency of 5.6.

The measures given for the wholesale price index have a value of zero, of course, because the turning points of that index provide the reference dates from which the other changes are measured.

Of the non-price series, the one which is most consistent in its time relation to the wholesale price index is the general business index of the American Telephone and Telegraph Company. Next in order is the index of industrial stock prices. The yield on railroad bonds is least consistent.

Two of the individual commodity price series listed in Table 26 have measures of inconsistency which are smaller than that of the most consistent of the non-price series. These two are pig iron prices and sole leather prices. The time relation between the cyclical movements of bituminous coal prices and the cyclical movements of general prices is least consistent. In general, the measures of inconsistency for the price series are large. Even where there is a distinct tendency to precede or lag behind general prices there is considerable variation in the degree of lead or lag. This is true, however, of most economic relations, and does not mean that principles of order cannot be found in the working of the price system. It means, only, that relations between prices are statistical and not mechanical in character, and that the interpretation and use of the data secured from studies in this field involve the calculus of probabilities rather than the rigid formulas of mechanics.

In Table XV, in the Appendix, the average time of revival for each of 209 commodities is shown. The averages for 56 commodities are negative in sign, which means that these articles have preceded the general price index, on the average, in their upward movements. These constitute a trifle over a quarter (26.8 per cent) of the total number of commodities. An up-turn of the general index, it is apparent, is due in general to price changes in a distinct minority of the commodities included in the index. The reason for this is found, probably, in the fact that toward the end of a period of depression the bulk of commodities on sale in the wholesale markets are fairly stable in price, at levels below those prevailing during the preceding period of prosperity. Under these conditions upward price movements which affect but a few commodities would serve to move the general index upward.

The averages vary from —13.4 for wheat to +36.5 for nappies. These are both somewhat exceptional values, the former because of the erratic character of wheat price movements (erratic when fitted into the general schedule of cyclical movements), the latter because nappies shared in but two general price revivals. If nine extreme cases be ruled out, the average times of revival of the remaining 200 articles fall between —7 and +15, a range of 22 months.

The entries in this general table must be so qualified that the table as a whole does not lend itself to simple interpretation. The average date of revival, as given for a single commodity, must be interpreted in connection with the number of price revivals recorded for that commodity, and with the measure of inconsistency. In addition to the limitations which these measures impose, a certain number of commodities in the farm products and food groups (26 in all) have been classed as "exceptional." Even though dates of revival and recession were located for these commodities in most cases, many of their price changes did not appear to have any necessary connection with the business cycle. Fitting them into the framework of general cyclical movements seemed a rather arbitrary procedure. In view of these limitations, general conclusions concerning the sequence of price movements during revival must be drawn with considerable caution.

The data are in such shape, however, that the abnormal and erratic commodities may be readily eliminated, and only those retained which are fairly consistent in responding to general upward movements of prices during revival. This has been done in preparing the table which follows. The 26 exceptional commodities have been excluded. All commodities which did not, in their price movements, reflect at least 8 of the 11 revivals which occurred during the period studied have been omitted from this list. Finally, all commodities for which the measures of inconsistency exceed 8.0 have been excluded. There remain, after these various eliminations, 66 commodities the prices of which reflected with some degree of consistency the general revivals in business. These appear below, listed in the order of their average dates of revival.

TABLE 28

Sequence of Revival in the Prices of a Selected Group of Commodities, with Measures of Inconsistency

(This table is restricted to the 66 commodities which were most consistent in their price movements during revival.)

(1) Ref. No.	(2) Commodity	(3) No. of price revivals	(4) Average deviation from reference date (in mos.)	(5) Measure of inconsistency
42	Hides	11	—7.0	6.1
17	Sheep, ewes	11	—5.7	7.5
13	Cattle	11	—5.5	7.2
228	Silk, raw, extra-extra	11	—3.4	5.4
138	Lard	9	—2.6	6.0
15	Hogs, heavy	11	—2.5	7.4
302	Zinc, slab	10	—2.4	4.6
56	Wool, fine clothing	9	—2.1	4.0
382	Tallow	11	—1.6	5.9
362	Alcohol, wood	10	—1.5	7.9
16	Hogs, light	11	—1.2	5.7
440	Leather, sole oak	11	—1.2	5.9
451	Rubber	10	— .9	7.2
297	Lead, pipe	9	— .8	6.2
441	Leather, sole oak, scoured backs	10	— .8	4.5
59	Wool, medium	9	— .7	4.5
158	Cottonseed oil	11	— .5	5.4
221	Worsted yarns, 2-40's	10	— .5	5.8
296	Lead, pig	11	— .5	6.3
226	Silk, raw, Kansai No. 1	11	— .4	6.6
293	Copper, ingot	11	— .2	7.5
71	Mutton	11	— .1	8.0
217	Storm serge	9	— .1	7.1
327	Brick	10	0	6.0
300	Tin, pig	11	+ .1	4.5
64	Beef, fresh	11	+ .3	7.7
239	Coke	11	+ .8	4.8
438	Leather, harness oak	11	+ .8	3.6
455	Starch, laundry	8	+1.1	7.7

TABLE 28 (Cont.)

(1) Ref. No.	(2) Commodity	(3) No. of price revivals	(4) Average deviation from reference date (in mos.)	(5) Measure of inconsistency
295	Copper wire	11	+1.3	6.2
433	Cottonseed meal	10	+1.4	5.7
263	Pig iron, foundry no. 2, southern	11	+1.5	3.4
68	Beef, salt	10	+1.9	7.8
220	Worsted yarns, 2-32's	11	+1.9	5.8
195	Print cloths	10	+2.0	6.3
247	Petroleum, crude	9	+2.4	7.3
267	Bar iron, Pitts.	11	+2.9	6.1
47	Milk	11	+3.1	7.3
261	Pig iron, foundry no. 2, northern	11	+3.1	4.6
294	Copper, sheet	10	+3.1	7.9
25	Cotton	10	+3.2	7.2
260	Pig iron, Bessemer	11	+3.2	5.2
266	Bar iron, Phila.	11	+3.5	5.9
276	Steel billets	11	+3.6	6.4
289	Wire, fence	10	+3.6	5.6
317	Pine, yellow siding	8	+3.6	5.5
206	Flannels, white	9	+3.7	6.8
248	Petroleum, refined, for export	8	+4.0	7.2
173	Men's shoes, chocolate elk	8	+4.1	4.9
191	Muslin, Lonsdale	11	+4.9	5.3
180	Denims	10	+5.0	7.5
259	Pig iron, basic	11	+5.1	4.5
423	Sheetings, 10-4 Pepperell	11	+5.1	7.6
198	Sheetings, 4-4 Ware Shoals	10	+5.3	6.4
291	Screws, wood	9	+5.6	6.5
417	Carpets, Axminster	8	+5.9	4.3
179	Calico	10	+6.0	7.8
210	Suiting, Middlesex	8	+6.0	7.5
306	Hemlock	8	+6.4	6.4
197	Sheetings, 4-4 Pepperell R	11	+6.8	7.4
269	Nails, wire	10	+7.1	5.8
184	Flannel, unbleached	9	+8.1	7.4
181	Drillings, Pepperell	10	+8.3	7.7
193	Muslin, Wamsutta	10	+9.9	5.4
400	Quinine	8	+11.0	7.2
288	Vises	9	+11.1	6.8

Of the 66 commodities here listed 23, or about 35 per cent of the total, precede the general revival of prices, on the average. The values range from the entry for hides, which has moved upward 7 months before a general price up-turn, to that for vises, which has turned 11 months after the index. The averages for all but 10 of the commodities fall within a range of 10 months, from —3 to +7.

We may carry the selective process further. In making up the following table there have been excluded the 26 exceptional commodities, all commodities which fail to reflect, in their price movements, all the revivals (11 in number) between 1892 and 1925, and all those for which the measure of inconsistency exceeds 6.5. The small group left includes only those of the 209 commodities which were most consistent in their movements during periods of revival. There are 20 price series in this group, representing 16 commodities.

TABLE 29

Sequence of Revival in the Prices of a Selected Group of Commodities, with Measures of Inconsistency

(This table is restricted to the 20 commodities which were most consistent in their price movements during revival.)

(1) Ref. No.	(2) Commodity	(3) Average deviation from reference date (in months)	(4) Measure of inconsistency
42	Hides	−7.0	6.1
228	Silk	−3.4	5.4
382	Tallow	−1.6	5.9
440	Leather, sole oak	−1.2	5.9
16	Hogs	−1.2	5.7
296	Lead, pig	− .5	6.3
158	Cottonseed oil	− .5	5.4
300	Tin pig	+ .1	4.5
438	Leather, harness oak	+ .8	3.6
239	Coke	+ .8	4.8
295	Copper wire	+1.3	6.2
263	Pig iron, foundry no. 2, southern	+1.5	3.4
220	Worsted yarns, 2-32's	+1.9	5.8
267	Bar iron, Pitts.	+2.9	6.1
261	Pig iron, foundry no. 2, northern	+3.1	4.6
260	Pig iron, Bessemer	+3.2	5.2
266	Bar iron, Phila.	+3.5	5.9
276	Steel billets	+3.6	6.4
191	Muslin	+4.9	5.3
259	Pig iron, basic	+5.1	4.5

The metals and metal products group, within which fall 10 of the 20 series, dominate this list. Because of the selective process employed in constructing this table considerable confidence may be attached to it, as indicating a sequence which, while not invariable, seems to have held in general during revival.

The following table permits a comparison of a selected list of commodities in respect to consistency in the timing of their price movements during revival. All those commodities which were not classed as exceptional and which passed through 9 cycles or more during the period from 1890 to 1925 have been included. Eighty four price series are in this list.

TABLE 30

Cycles in Commodity Prices, at Wholesale

Ranking of Eighty Four Price Series according to the Consistency of their Movements during Business Revivals

(The commodities for which the measures in column (4) are lowest are those which were most consistent in relation to the general price index during revival.)

(1) Ref. No.	(2) Commodity	(3) No. of cycles	(4) Measure of inconsistency in timing of revival
263	Pig iron, foundry no. 2, southern	10	3.4
438	Leather, harness oak	9	3.6
259	Pig iron, basic	10	4.5
300	Tin pig	10	4.5
441	Leather, sole oak, scoured backs	9	4.5
302	Zinc, slab	9	4.6
261	Pig iron, foundry no. 2, northern	10	4.6
239	Coke	10	4.8
260	Pig iron, Bessemer	10	5.2
191	Muslin, Lonsdale	10	5.3
158	Cottonseed oil	10	5.4
228	Silk, raw, extra-extra	10	5.4
193	Muslin, Wamsutta	9	5.4
289	Wire, fence	9	5.6
16	Hogs, light	10	5.7
433	Cottonseed meal	9	5.7
221	Worsted yarns, 2-40's	9	5.8
269	Nails, wire	9	5.8
220	Worsted yarns, 2-32's	10	5.8
382	Tallow	10	5.9
266	Bar iron, Phila.	10	5.9
440	Leather, sole oak	10	5.9
327	Brick	9	6.0
42	Hides	10	6.1
267	Bar iron, Pitts.	10	6.1
295	Copper wire	10	6.2
195	Print cloths	9½	6.3
296	Lead, pig	10	6.3
198	Sheetings, 4-4, Ware Shoals	9	6.4
276	Steel billets	10	6.4
291	Wood screws	9	6.5
226	Silk, raw, Kansai No. 1	10	6.6
25	Cotton	9½	7.2
13	Cattle, choice to prime	10	7.2
451	Rubber	9	7.2
47	Milk	10	7.3
197	Sheetings, 4-4 Pepperell	10	7.4
15	Hogs, heavy	10	7.4
180	Denims	9½	7.5
293	Copper, ingot	10	7.5
17	Sheep, ewes	10	7.5
423	Sheetings, 10-4 Pepperell	10	7.6
181	Drillings, Pepperell	9½	7.7
64	Beef, fresh	10	7.7
68	Beef, salt	9	7.8

TABLE 30 (Cont.)

(1) Ref. No.	(2) Commodity	(3) No. of cycles	(4) Measure of inconsistency in timing of revival
179	Calico	9	7.8
294	Copper, sheet	9	7.9
362	Alcohol, wood	9	7.9
71	Mutton	10	8.0
190	Muslin, Fruit of the Loom	10	8.0
436	Leather, calf	10	8.1
430	Tickings	9½	8.3
69	Hams	10	8.3
348	Linseed oil	10	8.3
19	Sheep, wethers	10	8.4
319	Poplar	9	8.4
196	Sheetings, 4-4 Indian Head	9½	8.5
14	Cattle, good to choice	10	8.8
298	Quicksilver	9	8.8
345	Glass, window, B	10	8.8
186	Ginghams, Lancaster	9	8.8
203	Cotton yarns, cones 22/1	10	9.1
74	Pork, cured, salt mess	10	9.1
448	Jute	10	9.1
344	Glass, window, A	9	9.1
139	Meal, corn, fine white	9	9.2
140	Meal, corn, yellow, table	9	9.2
76	Pork, short clear sides	9	9.7
75	Pork, rough sides	9	9.7
202	Cotton yarns, cones 10/1	9½	9.7
115	Mackerel	9	9.8
53	Rice	9	9.8
130	Prunes	10	10.8
185	Ginghams, Amoskeag	10	10.8
321	Spruce	9	10.9
450	Rope	10	10.9
192	Muslin, Rough Rider	10	10.9
353	Turpentine, spirits of	9	11.2
350	Rosin	9	11.4
354	Lead, carbonate of	10	11.7
397	Opium	9	11.7
109	Coffee	10	12.5
236	Bituminous coal, Kanawha	9½	13.2
182	Drillings, Mass. D	9½	13.3

The measures of inconsistency range from 3.4 for one grade of pig iron to 13.3 for cotton drillings, the mean being 7.7. Detailed comment on the table is unnecessary.

c. *Duration of Periods of Rising Prices.* The rising prices which are initiated by the turns described in the preceding section endure for varying periods. For the fifteen selected commodities included in the following table the averages range from 13.7 months for bituminous coal to 57.6 months for steel rails. (The latter figure relates to a commodity which went through but 5 complete cycles during the years from 1890 to 1925, which fact accounts for the extremely high average.) In presenting the individual averages the commodities are ranked in the order of magnitude of the measure of duration.

TABLE 31

CYCLES IN COMMODITY PRICES, AT WHOLESALE

Ranking of Fifteen Commodities according to Average Duration of the Period of Rising Prices

(1) Ref. No.	(2) Commodity	(3) Average duration of rising prices (in months)
236	Bituminous coal	13.7
259	Pig iron	14.8
276	Steel billets	16.7
293	Copper, ingot	18.6
233	Anthracite coal	19.7
239	Coke	20.7
195	Print cloths	21.7
202	Cotton yarns	22.6
25	Cotton	23.2
451	Rubber	23.7 (22.4)
64	Beef	24.4
441	Leather	26.2 (19.2)
13	Cattle	27.1
247	Petroleum	29.9 (25.0)
280	Steel rails	57.6 (18.5)

For comparison with the above entries the corresponding figures relating to seven general economic series are given in the next table.

TABLE 32

CYCLES IN SELECTED ECONOMIC SERIES

Ranking of Seven Series according to the Average Duration of Period of Rise

(1) Series	(2) Average duration of rise (in months)	(3) Average duration of rise as percentage of average duration of cycle
Yield on fifteen railroad bonds	17.6	44.4
Interest rate on call loans	22.4	58.0
Index of industrial stock prices (Dow-Jones)[1]	23.4	59.4
Index of wholesale commodity prices (U. S. B. of L. S.)	23.4	60.8
Discount rate on 60-90 day paper	24.5	63.1
Index of general business conditions (A. T. & T.)	26.0	65.5
Pig iron production	27.6	69.2

[1] The average duration of rise for Macaulay's index of railroad stock prices was 22.6 months, this being 56.6 per cent of the average duration of the cycle.

Measures showing the average duration of the periods of rising prices for all the commodities studied are given in Table XVI, in the Appendix. The commodities are listed by groups, in order of magnitude of the averages.

In computing the averages upon which the ranking is based all periods of rising prices, whether they extended over one or several cycles in general business, have been included. In computing the second averages in Table 31 and in Table XVI (the figures in parentheses) those periods of rise which extended over more than one phase of revival have been excluded. In using these figures, as in using all the averages given in this section, attention should be paid to the number of entries upon which a given measure is based. This information may be had from Appendix Table XII.

As with the other measures studied, the duration of the period of rise varies considerably. The shortest period, if we restrict the comparison to commodities which reflected all the cyclical movements, is that for pig iron (commodity no. 259). The price of this commodity rose, on the average, for but 14.8 months before recession set in. The longest average rise for commodities which passed through all the cycles is 27.1 months, which was recorded for the prices of cattle and raw silk.

There have been included in Table 32 figures giving the percentage relation of the average period of rise to the average duration of the cycle for individual series. As was pointed out at an earlier point, there are important differences between economic series in respect to the make-up of the complete cycle. Some series have a short period of rise and a long period of decline, while others have a relatively long period of rise and a sharp, short recession. The only one of the general series listed for which the average duration of the period of rise is less than 50 per cent of the complete cycle is that showing the yield on fifteen railroad bonds. (A measure relating to the *price* of railroad bonds would show a period of rise constituting more than 50 per cent of the complete cycle.)

Similar percentages have not been given for the price series listed in Table 31 because of the variation in the number of cycles through which the different series passed. To render such percentages comparable the effect of "missed" cycles must be eliminated. This has been done in preparing Table 33. There have been omitted from this table all those commodities (59 in number) the prices of which passed through less than 5 distinct cycles between 1890 and 1925. As defined in preparing this one table, a "cycle" consists of a period of rise and the ensuing period of decline, the rise and decline together not extending over more than one complete cycle in general business. (As generally used throughout this study, the cycle is less narrowly defined. That term is used to describe a period of rise and the ensuing period of fall, whether this rise and fall extend over one or more than one cycle in general business.) This narrowing of the definition validates the comparison of percentages of the type given in Tables 32 and 33. Table 33 includes data relating to 150 commodities, each of which in its price movements reflected from 5 to 10 cycles. For each of these commodities there are given the number of cycles (as above defined) through which it passed, the average duration of the period of rise, the average duration of the cycle, and the percentage relation of the two latter measures.[1]

The percentages show a wide variation, ranging from 35.1 to 82.4, the figures for door knobs and wrapping paper, respectively. If the comparison be restricted for the moment to those commodities which passed through all 10 cycles, the range is from 39.2 per cent for pig iron to 73.2 per cent for cattle. The usual cycle, for pig iron prices, consists of a short period of rise and a long period of decline; for the price of cattle it consists of a long rise, covering three-quarters of the cycle, and a sharp decline.

For only 33 of the 150 commodities represented in the table is the period of rising prices shorter than the period of decline. For commodities in general the typical cycle consists of a period of rise distinctly longer than the ensuing period of fall. For the great bulk of commodity prices at wholesale the period of rise covers from 50 per cent to 70 per cent of the total length of the cycle.

In interpreting Table 33 due account should be taken of the commodities which are starred as exceptional. The description of their price movements in terms of "cycles" involves some arbitrary classifications, since their price fluctuations reflect in considerable part the influence of forces which are not closely related to cycles in industry or business.

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[1] The figures for number of cycles, duration of rise and duration of cycle, as given in Table 33, do not agree, in all cases, with the entries in Tables XII, XIII and XVI. This is because of the narrower definition of the cycle and of its constituent phases which was followed in preparing Table 33.

In computing the average duration of rise given in Table 33 only those periods of rise have been included which extended over but one phase of revival (and prosperity) and which were followed by a period of fall which extended over but one phase of recession (and depression). This double condition is necessary because the object of study is the relation of the period of rise to the length of the complete cycle. Only the first of these two conditions applied in computing the second entries in Table XVI. Interest here attached only to the period of rise, as a distinct phenomenon.

TABLE 33

CYCLES IN COMMODITY PRICES, AT WHOLESALE

RANKING OF 150 COMMODITIES ACCORDING TO THE PERCENTAGE RELATION OF THE AVERAGE PERIOD OF RISING PRICES TO THE AVERAGE LENGTH OF THE PRICE CYCLE

(The commodities in this list include all those which, between 1890 and 1925, passed through five or more distinct cycles, corresponding to cycles in general business.)[1]

(1) Ref No.	(2) Commodity	(3) No. of cycles	(4) Duration of rise, average (mos.)	(5) Duration of cycle, average (mos.)	(6) Duration of rise as percentage of duration of cycle
253	Door knobs	6	13.7	39.0	35.1
236	Bituminous coal, Kanawha	9	14.7	39.9	36.8
355	Zinc, oxide of	6	13.3	35.2	37.8
259	Pig iron, basic	10	14.8	37.8	39.2
433	Cottonseed meal	8	15.1	38.0	39.7
116	Salmon	6	17.0	42.5	40.0
288	Vises	6	15.8	39.5	40.0
130	Prunes	10	16.2	39.1	41.4
173	Men's shoes, chocolate elk	6	15.2	36.7	41.4
295	Copper wire	10	16.6	39.0	42.6
152	*Tea	9	16.9	38.8	43.6
276	Steel billets	10	16.7	38.1	43.8
258	Locks	6	17.3	39.3	44.0
249	Petroleum, refined	5	18.8	42.6	44.1
261	Pig iron, foundry no. 2, northern	10	16.7	37.8	44.2
128	*Apples	8	17.6	39.7	44.3
238	Bituminous coal, Pocahontas	7	17.4	39.1	44.5
324	Shingles	6	16.5	37.0	44.6
49	*Onions	10	17.0	37.4	45.5
260	Pig iron, Bessemer	10	17.3	38.0	45.5
267	Bar iron, Pitts.	10	17.8	39.1	45.5
129	*Currants	9	18.4	39.9	46.1
400	Quinine	6	19.8	42.5	46.6
22	*Beans	10	18.3	38.4	47.7
293	Copper, ingot	10	18.6	38.8	47.9
294	Copper, sheet	9	18.7	38.7	48.3
301	Zinc	7	17.6	36.1	48.8
274	Shovels	5	18.6	38.0	48.9
115	Mackerel	9	20.6	41.9	49.2
181	Drillings, Pepperell	9	18.9	38.3	49.3
251	Butts	6	18.5	37.5	49.3
141	Molasses	5	22.8	45.8	49.8
263	Pig iron, foundry no. 2, southern	10	19.2	38.5	49.9
198	Sheetings, 4-4 Ware Shoals	8	20.3	40.4	50.2
179	Calico	8	19.9	39.6	50.3
436	Leather, calf	10	20.1	39.7	50.6
44	*Hops	6	22.5	44.3	50.8
5	*Rye	7	19.3	37.9	50.9
266	Bar iron, Phila.	10	20.1	39.2	51.3
302	Zinc, slab	9	20.1	39.2	51.3
2	*Corn	9	20.4	39.7	51.5
269	Nails, wire	8	20.0	38.7	51.7

TABLE 33 (Cont.)

(1) Ref. No.	(2) Commodity	(3) No. of cycles	(4) Duration of rise, average (mos.)	(5) Duration of cycle, average (mos.)	(6) Duration of rise as percentage of duration of cycle
327	Brick	8	20.0	38.5	51.9
119	*Flour, wheat	7	21.7	41.6	52.2
220	Worsted yarns, 2-32's	10	19.9	38.1	52.2
195	Print cloths	9	20.9	39.9	52.4
193	Muslin, Wamsutta	9	20.8	39.6	52.5
393	Alcohol, grain	7	20.6	39.1	52.7
438	Leather, harness oak	8	19.1	36.2	52.8
109	Coffee	10	19.9	37.6	52.9
53	Rice	8	21.0	39.6	53.0
37	*Hay	7	21.7	40.9	53.1
299	Silver	7	21.7	40.9	53.1
161	*Vinegar	8	20.9	39.2	53.3
424	Sheeting, 10-4 Wamsutta	7	20.6	38.6	53.4
319	Poplar	8	21.0	39.0	53.8
4	*Oats	9	22.2	41.2	53.9
16	Hogs, light	10	20.7	38.4	53.9
202	Cotton yarns, cones 10/1	9	21.6	39.9	54.1
441	Leather, sole oak, scoured backs	8	19.2	35.5	54.1
192	Muslin, Rough Rider	10	20.0	36.8	54.3
15	Hogs, heavy	10	21.2	38.8	54.6
239	Coke	10	20.7	37.9	54.6
451	Rubber	8	22.4	40.7	55.0
344	Glass, window, A	8	21.6	39.2	55.1
443	Paper, newsprint	7	21.3	38.6	55.2
74	Pork, salt mess	10	21.1	38.1	55.4
321	Spruce	8	22.1	39.9	55.4
138	Lard	6	22.2	40.0	55.5
308	Maple	5	20.4	36.6	55.7
350	Rosin	8	20.6	37.0	55.7
248	Petroleum, refined for export	5	21.4	38.2	56.0
197	Sheetings, 4-4 Pepperell R	10	22.5	40.0	56.3
146	*Salt	7	21.7	38.4	56.5
289	Wire, fence	9	22.3	39.4	56.6
450	Rope	10	22.0	38.8	56.7
25	Cotton	9	22.1	38.7	57.1
196	Sheetings, 4-4 Indian Head	9	22.4	39.0	57.4
291	Screws, wood	8	23.1	40.2	57.5
203	Cotton yarns, cones 22/1	10	23.7	40.8	58.1
247	Petroleum, crude	6	21.9	37.7	58.1
51	*Potatoes	10	22.8	39.1	58.3
296	Lead, pig	10	22.1	37.9	58.3
90	*Butter, dairy	10	23.3	39.9	58.4
158	Cottonseed oil	10	22.6	38.5	58.7
75	Pork, rough sides	8	24.4	41.4	58.9
352	Tar	8	25.0	42.4	59.0
1	*Barley	10	22.1	37.3	59.2
423	Sheetings, 10-4 Pepperell	10	23.0	38.8	59.3
180	Denims	9	23.4	39.2	59.7
300	Tin, pig	10	23.3	38.9	59.9
298	Quicksilver	8	20.2	33.6	60.1

TABLE 33 (Cont.)

(1) Ref. No.	(2) Commodity	(3) No. of cycles	(4) Duration of rise, average (mos.)	(5) Duration of cycle, average (mos.)	(6) Duration of rise as percentage of duration of cycle
69	Hams	10	23.9	39.7	60.2
345	Glass, window, B	10	24.0	39.9	60.2
89	*Butter, N. Y.	10	24.0	39.8	60.3
95	*Butter, St. Louis	10	24.0	39.8	60.3
117	*Flour, rye	5	30.2	50.0	60.4
59	Wool, medium	7	22.8	37.7	60.5
210	Suiting, Middlesex	5	21.4	35.4	60.5
149	*Sugar, raw	8	25.5	42.1	60.6
448	Jute	10	23.4	38.6	60.6
297	Lead, pipe	8	24.1	39.7	60.7
76	Pork, short clear sides	8	25.0	41.1	60.8
185	Ginghams, Amoskeag	10	25.0	41.0	61.0
131	Raisins	5	26.2	42.8	61.2
430	Tickings	9	23.3	38.1	61.2
312	Oak, white quartered	7	23.9	38.9	61.4
382	Tallow	10	23.5	38.3	61.4
113	Cod	8	26.8	43.5	61.6
354	Lead, carbonate of	10	24.1	39.0	61.8
440	Leather, sole oak, in sides	10	24.1	38.9	62.0
397	Opium	9	24.4	39.2	62.2
150	*Sugar, granulated	8	26.6	42.7	62.3
145	Pepper	6	26.3	42.0	62.6
191	Muslin, Lonsdale	10	23.8	38.0	62.6
64	Beef, fresh	10	24.4	38.9	62.7
99	*Cheese	10	24.9	39.3	63.4
71	Mutton	10	25.1	39.5	63.5
56	Wool, fine clothing	7	24.0	37.7	63.7
237	Bituminous coal, New River	7	24.0	37.7	63.7
68	Beef, salt	8	23.1	36.1	64.0
17	Sheep, ewes	10	24.5	38.2	64.1
34	*Flaxseed	6	25.2	39.3	64.1
353	Turpentine	8	25.7	40.1	64.1
120	*Flour, wheat	7	26.1	40.4	64.6
42	Hides	10	24.9	38.3	65.0
221	Worsted yarns, 2-40's	8	27.0	41.5	65.1
186	Ginghams, Lancaster	8	25.3	38.8	65.2
19	Sheep, wethers	10	24.8	38.0	65.3
182	Drillings, Mass. D	9	25.4	38.9	65.3
216	Serge, French	5	30.2	46.2	65.4
396	Glycerine	7	22.9	34.9	65.6
14	Cattle, good to choice	10	25.7	38.9	66.1
31	*Eggs	6	24.0	36.2	66.3
47	Milk	10	25.5	38.4	66.4
313	Pine, white boards	5	28.4	42.4	67.0
217	Serge, storm	7	29.0	43.1	67.3
348	Linseed oil	10	25.9	38.5	67.3
226	Silk, raw, Kansai No. 1	10	26.5	39.1	67.8
139	Meal, corn, fine white	9	27.4	40.3	68.0
183	Flannel, colored	7	26.1	38.1	68.5
190	Muslin, Fruit of the Loom	10	26.3	38.2	68.8

TABLE 33 (Conc)

(1) Ref. No.	(2) Commodity	(3) No. of cycles	(4) Duration of rise, average (mos.)	(5) Duration of cycle, average (mos.)	(6) Duration of rise as percentage of duration of cycle
417	Carpets, Axminster	5	29.6	42.8	69.2
228	Silk, raw, extra-extra	10	27.1	39.0	69.5
184	Flannel, unbleached	8	26.9	38.5	69.9
362	Alcohol, wood	8	27.4	38.6	71.0
206	Flannels, white	7	27.0	37.7	71.6
140	Meal, corn, yellow table	9	29.1	40.3	72.2
13	Cattle, choice to prime	10	27.1	37.0	73.2
444	Paper, wrapping	5	31.8	38.6	82.4

*The commodities marked with an asterisk have price movements which are irregular, in the sense that they do not conform in any systematic fashion to the cyclical movements of general prices.

[1] It seems desirable to give, for the remainder of the 209 commodities included in this analysis, the number of recorded cycles, as defined in preparing the above table. The following list includes 59 commodities the prices of which passed through less than five cycles, as defined for the present purpose.

(1) Ref.No.	(2) Commodity	(3) No. of cycles	(1) Ref.No.	(2) Commodity	(3) No. of cycles
6	Wheat	4	287	Trowels	0
104	Bread, Cincinnati	0	306	Hemlock	4
106	Bread, N. Y.	3	310	Oak, white plain	2
111	Crackers, oyster	3	317	Pine, yellow	3
112	Crackers, soda	4	323	Shingles	3
114	Herring	4	335	Doors	3
148	Starch, corn	1	338	Lime	3
166	Men's shoes, black calf	2	349	Putty	3
174	Men's shoes, vici kid	0	357	Acid, muriatic	3
177	Women's shoes	3	360	Acid, sulphuric	2
199	Cotton thread	2	363	Alum	3
213	Underwear, shirts and drawers	1	377	Soda, bicarbonate of	3
214	Underwear, union suits	0	381	Sulphur, brimstone	3
215	Broadcloth	3	405	Bedroom chairs	1
218	Poplar cloth	3	406	Bedroom sets	2
219	Sicilian cloth	3	412	Kitchen chairs	4
223	Linen shoe thread	0	414	Kitchen tables	0
232	Anthracite coal, broken	3	418	Carpets, Brussels	3
233	Anthracite coal, chestnut	3	419	Carpets, Wilton	3
234	Anthracite coal, egg	2	422	Pails	2
235	Anthracite coal, stove	2	425	Nappies	0
244	Matches	0	426	Pitchers	3
250	Augers	2	427	Tumblers	2
252	Chisels	2	428	Plates, white granite	0
254	Files	2	429	Teacups and saucers	0
255	Hammers	2	431	Tubs	1
271	Planes	0	455	Starch, laundry	4
272	Saws, crosscut	0	456	Tobacco, plug	1
273	Saws, hand	0	457	Tobacco, smoking	0
280	Steel rails	4			

Reference should be made, in using this table, to the column showing the number of cycles upon which the percentages are based. The figures are, of course, most representative for those commodities which passed through all 10 cycles. The figures do not lose significance if based upon less than 10 cycles, but their usefulness for purposes of comparison is somewhat lessened. This is so because business cycles vary in length, in the relative duration of their constituent phases, and in other characteristics.

To complete the information concerning individual commodities which Table 33 yields, there is shown in a footnote the number of cycles, as defined in the construction of this table, through which the prices of the 59 excluded commodities passed.

The only remaining figures relating to price behavior during revival are those showing the average percentages of rise. These are given in column (9) of Table XII (as percentages of the low values) and in column (19) (as percentages of the ensuing high values). With minor exceptions the ranking of commodities on the basis of this measure would be the same as the ranking on the basis of cyclical variability, which is shown in Table XIV. This ranking need not be repeated.

4. Behavior of Commodity Prices During Recession

In following the behavior of commodity prices during recession, interest will attach not only to the actual values of the individual measures, but to such differences as may be observed between the behavior of individual commodities at the time of recession and the behavior of these commodities during revival.

a. *Degree of Conformity to General Price Movements during Recession.* The exceptions to the general movements of price recession may first be noted. Two of the fifteen selected commodities were constant in price during general price recessions. These were anthracite coal (constant during 4 out of 10 recessions) and steel rails (constant during 5 of the 10 recessions). Only one of these fifteen commodities, petroleum, was marked by sagging prices during a period when a turn downward from a high point was being recorded for prices in general. Four registered rising prices during recessions. Petroleum, leather and rubber each rose during one period of general recession, and anthracite coal rose during three periods of recession.

Table XII in the Appendix gives information of this type for all the commodities studied. The various individual entries relating to behavior at recession are summarized in the following table. The data available relate to 209 commodities during 10 periods of recession. The 2090 observations are divided as follows:

TABLE 34

BEHAVIOR OF ALL COMMODITIES DURING PRICE RECESSIONS

(1) Nature of entry	(2) No. of entries	(3) Percentage of total
Specific date (for beginning of recession)	1629	77.9
Constant	241	11.5
Sagging	95	4.6
Rising	125	6.0
Total	2090	100.0

These figures correspond rather strikingly to those entered in Table 25, relating to behavior during revival. On the average, almost 80 per cent of all wholesale commodity prices have been affected by general price recessions, and in about half of the remaining cases prices have been constant. The small differences between the number entered as sagging and the number entered as rising in Tables 25 and 34 are natural. After depression a rather larger fraction would be expected to continue to sag, and after revival one would expect a somewhat larger percentage to continue to rise, than in the reverse situations.

b. *Sequence of Change in Commodity Prices during Recession.* The average order in which the prices of fifteen selected commodities have changed during general price recessions is shown below.

TABLE 35

SEQUENCE OF RECESSION IN SELECTED WHOLESALE PRICE SERIES, WITH MEASURES OF INCONSISTENCY

Ranking of Fifteen Commodities according to the Timing of Price Recession, 1890-1925

(The figures in column (4) measure deviations, in months, from the date when the general index of wholesale prices reached its highest point, preceding recession. The sign (—) indicates a price recession *preceding* that in general prices; the sign (+) indicates a price recession *lagging behind* the recession in general prices.)

(1) Ref. No.	(2) Commodity	(3) No. of price recessions	(4) Average deviation from reference date (in months)	(5) Measure of inconsistency
451	Rubber	9	—6.4	9.9
293	Copper, ingot	10	—3.7	5.4
259	Pig iron	10	—2.2	4.8
276	Steel billets	10	—2.0	2.9
13	Cattle	10	—1.5	5.5
441	Leather	9	—1.5	6.8
239	Coke	10	— .5	7.6
195	Print cloths	10	+ .9	7.0
64	Beef	10	+1.2	6.0
236	Bituminous coal	10	+2.2	5.0
25	Cotton	10	+3.3	5.8
202	Cotton yarns	10	+3.7	6.2
280	Steel rails	5	+5.5	5.7
233	Anthracite coal	3	+6.3	7.4
247	Petroleum	8	+6.9	8.4

In the computation of the averages given in column (4) and the measures in column (5), the entries for period 16 have been omitted, though the number of recessions entered in column (3) includes all the price recessions between 1890 and 1925. Period 16 has been omitted in computing the average date of recession and the measures of inconsistency because of the abnormal conditions created by war-time expansion and price regulation. It is believed that a more representative figure has been secured by this omission.

Following are the corresponding measures for seven general economic series. Results based upon all periods are given, in addition to those in which the entries for period 16 have been omitted. The latter should be employed in making comparisons with the measures relating to commodity prices.

TABLE 36

SEQUENCE OF RECESSION IN SEVEN ECONOMIC SERIES, WITH MEASURES OF INCONSISTENCY

(1) Series	(2)	(3)	(4)	(5)
	Average deviations from reference date (in months)		Measures of inconsistency	
	All periods	All periods except no. 16	All periods	All periods except no. 16
Index of industrial stock prices (Dow-Jones)[1]	—9.5	—8.1	7.3	6.4
Index of general business conditions (A. T. & T.)	—1.8	—1.9	2.6	2.7
Interest rate on call loans	— .8	—1.0	5.5	5.8
Pig iron production	— .5	— .5	4.8	5.1
Index of wholesale prices (U. S. B. of L. S.)	0	0	0	0
Discount rate on 60-90 day commercial paper	+4.1	+4.4	4.8	5.0
Yield on fifteen railroad bonds	+5.0	+5.5	7.7	8.0

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[1] Corresponding measures for Macaulay's index of railroad stock prices, in the order in which the above items appear, are −8.8, −7.2, 6.7 and 5.0. It is worthy of note that both measures of inconsistency are lower than for industrial stock prices.

It is a significant fact that with one exception the measures of inconsistency relating to the dates of recession in these general series are lower than the corresponding measures relating to dates of revival. During periods of recession these general series, with the single exception of the stock price index, move with greater consistency (i. e. there is less variation in the observed sequence from cycle to cycle) than at the phases of revival.

Similar changes are observable in the relations between the price series listed in Tables 26 and 35. There are some notable differences between the degrees of lead and lag observable in the prices of individual commodities during revival and recession, and there are a few radical shifts in time relationships. None of the four commodities that lead during revival lags during recession, but three important commodities that lag on revival undergo a price recession before the general index. These are pig iron, which lags by 5.1 months on revival and leads by 2.2 months during recession; steel billets, that lag by 3.6 months on revival and lead by 2.0 months on recession; and coke, that lags by .8 of a month on revival and leads by .5 of a month on recession. It is worthy of note that pig iron production, which on revival leads pig iron prices by 9.3 months, lags behind pig iron prices during recession by 1.7 months. Iron and steel prices appear to pick up tardily on revival, but feel the influence of impending recession before the general price structure is affected.

For 8 of the 15 commodities listed above the measures of inconsistency are smaller for the recession phase than for the phase of revival. The inconsistency measure for steel billets is the smallest in the group, having a value of 2.9. This is materially below the value of 6.4, recorded for the same commodity during revivals.

The average time of recession for each of the commodities included in the general study is given in Appendix Table XVII. Of the total number of commodities (209) 74 have, on the average, preceded the general index during periods of price recession. These constitute 35.4 per cent of the total. This figure is somewhat greater than the corresponding entry for periods of revival, which was 26.8 per cent. In both cases the bulk of the commodities lag behind the general index, but the proportion thus lagging varies from about three-quarters during revival to about two-thirds during recession.

The extreme entries in this table range from —16.4, for wheat (one of the exceptional commodities) to +14.0, for trowels and manila wrapping paper. Ruling out five somewhat abnormal cases, the remaining 204 entries fall between —7 and +14, a range of 21 months.

As in studying the sequence of turns during revival, it seems desirable to concentrate attention on those commodities which have been most consistent in their cyclical movements. In Table 28 there were shown figures relating to the dates of revival of the 66 most consistent commodities. It will be of interest to compare the behavior of these commodities during recession with their behavior during revival.

TABLE 37

Sequence of Recession in the Prices of a Selected Group of Commodities, with Measures of Inconsistency

(This group includes the 66 commodities which were most consistent in their price movements during revival.)

(1) Ref. No.	(2) Commodity	(3) No. of price recessions	(4) Average deviation from reference date (in months)	(5) Measure of inconsistency
451	Rubber	9	—6.4	9.9
42	Hides	10	—5.7	3.1
59	Wool, medium	8	—5.6	10.0
433	Cottonseed meal	9	—4.9	7.1
56	Wool, fine clothing	8	—4.6	9.9
15	Hogs, heavy	10	—4.2	4.1
295	Copper, wire	10	—4.2	5.4
267	Bar iron, Pitts.	10	—4.0	7.7
17	Sheep, ewes	10	—3.9	3.3
16	Hogs, light	10	—3.8	3.8
293	Copper, ingot	10	—3.7	5.4
302	Zinc slab	9	—3.7	6.2
138	Lard	8	—3.3	6.1
173	Men's shoes, chocolate elk	7	—2.4	4.5
327	Brick	9	—2.4	9.5
259	Pig iron, basic	10	—2.2	4.8
261	Pig iron, foundry no. 2, northern	10	—2.2	4.1
263	Pig iron, foundry no. 2, southern	10	—2.0	4.5
276	Steel billets	10	—2.0	2.9
220	Worsted yarns, 2-32's	10	—1.9	6.7
382	Tallow	10	—1.8	5.3
221	Worsted yarns, 2-40's	9	—1.6	4.1
226	Silk, raw, Kansai No. 1	10	—1.6	5.4
13	Cattle, choice to prime	10	—1.5	5.5
441	Leather, sole oak, scoured backs	9	—1.5	6.8
317	Pine, yellow siding	5	—1.4	3.2
294	Copper, sheet	9	—1.2	5.7
260	Pig iron, Bessemer	10	—1.1	3.7
297	Lead pipe	8	—1.0	5.1
158	Cottonseed oil	10	— .6	4.6
239	Coke	10	— .5	7.6
296	Lead, pig	10	— .4	6.4
266	Bar iron, Phila.	10	— .3	4.2
228	Silk, raw, extra-extra	10	— .1	5.6
300	Tin, pig	10	+ .4	7.4
438	Leather, harness oak	9	+ .6	7.5
455	Starch, laundry	7	+ .7	4.9
195	Print cloths	10	+ .9	7.0
440	Leather, sole oak,	10	+ .9	6.1
64	Beef, fresh	10	+1.2	6.0
71	Mutton	10	+1.8	8.8
68	Beef, salt	9	+1.9	7.3
179	Calico	9	+2.0	3.0
198	Sheetings, 4-4 Ware Shoals	10	+2.1	7.4
289	Wire, fence	9	+2.2	5.0
362	Alcohol, wood	9	+2.5	7.0
210	Suiting, Middlesex	7	+3.0	4.8

TABLE 37 (Cont.)

(1) Ref. No.	(2) Commodity	(3) No. of price recessions	(4) Average deviation from reference date (in months)	(5) Measure of inconsistency
400	Quinine	8	+3.1	9.5
25	Cotton	10	+3.3	5.8
217	Storm serge	8	+3.7	6.9
423	Sheetings, 10-4 Pepperell	10	+3.8	6.2
288	Vises	8	+3.9	7.3
269	Nails, wire	9	+4.2	5.8
306	Hemlock	6	+4.2	3.8
47	Milk	10	+5.7	7.6
181	Drillings, Pepperell	10	+5.9	5.5
191	Muslin, Lonsdale	10	+6.0	6.1
206	Flannels, white	8	+6.0	2.1
248	Petroleum, refined for export	7	+6.1	5.3
197	Sheetings, 4-4 Pepperell R	10	+6.3	7.0
180	Denims	10	+6.7	5.9
247	Petroleum, crude	8	+6.9	8.4
291	Screws, wood	10	+6.9	7.1
417	Carpets, Axminster	7	+7.0	3.6
193	Muslin, Wamsutta	9	+7.4	4.4
184	Flannel, unbleached	9	+11.0	8.7

On revival, it was noted, 23 of the 66, or about 35 per cent, preceded the general price index. At the recession stage 34 of the 66, or almost 52 per cent of the total, precede the general index. There is a fairly marked shift here. There are, in addition, a considerable number of changes in relative position. For the commodities in this group the correlation between the averages relating to time of revival and the averages relating to time of recession is measured by a coefficient of +.67. There is a tendency, it is apparent, for the sequence which prevails during revival to prevail also during recession, but the relationship is very far from being a perfect one. Further reference is made to this point in a later section.

A survey of the general tables shows that the commodities which were most consistent during revival were not, in all cases, the most consistent during recession. Table 37 does not, accordingly, include the 66 commodities which were most consistent during recession. These appear in the following table. In preparing this table there have been excluded all exceptional commodities, all those commodities which did not reflect at least 8 of the 10 general price recessions, and all those for which the measure of inconsistency was greater than 7.2. This leaves us with a compact group of commodities which have been fairly consistent during recessions in general business.

TABLE 38

Sequence of Recession in the Prices of a Selected Group of Commodities, with Measures of Inconsistency

(This table is restricted to the 66 commodities which were most consistent in their price movements during recession.)

(1) Ref. No.	(2) Commodity	(3) No. of price recessions	(4) Average deviation from reference date (in months)	(5) Measure of inconsistency
42	Hides	10	—5.7	3.1
19	Sheep, wethers	10	—4.9	4.9
433	Cottonseed meal	9	—4.9	7.1
15	Hogs, heavy	10	—4.2	4.1
295	Copper, wire	10	—4.2	5.4
17	Sheep, ewes	10	—3.9	3.3
16	Hogs, light	10	—3.8	3.8
293	Copper, ingot	10	—3.7	5.4
302	Zinc, slab	9	—3.7	6.2
138	Lard	8	—3.3	6.1
259	Pig iron, basic	10	—2.2	4.8
261	Pig iron, foundry no. 2, northern	10	—2.2	4.1
263	Pig iron, foundry no. 2, southern	10	—2.0	4.5
276	Steel billets	10	—2.0	2.9
220	Worsted yarns, 2-32's	10	—1.9	6.7
382	Tallow	10	—1.8	5.3
221	Worsted yarns, 2-40's	9	—1.6	4.1
226	Silk, raw, Kansai No. 1	10	—1.6	5.4
13	Cattle, choice to prime	10	—1.5	5.5
441	Leather, sole oak, scoured backs	9	—1.5	6.8
294	Copper, sheet	9	—1.2	5.7
260	Pig iron, Bessemer	10	—1.1	3.7
297	Lead pipe	8	—1.0	5.1
14	Cattle, good to choice	10	— .7	6.2
158	Cottonseed oil	10	— .6	4.6
296	Lead, pig	10	— .4	6.4
266	Bar iron	10	— .3	4.2
228	Silk, raw, extra-extra	10	— .1	5.6
450	Rope	10	+ .3	3.7
195	Print cloths	10	+ .9	7.0
440	Leather	10	+ .9	6.1
353	Turpentine	9	+1.0	5.6
69	Hams	10	+1.1	6.5
64	Beef, fresh	10	+1.2	6.0
179	Calico	9	+2.0	3.0
236	Bituminous coal, Kanawha	10	+2.2	5.0
289	Wire, fence	9	+2.2	5.0
298	Quicksilver	9	+2.4	5.0
362	Alcohol, wood	9	+2.5	7.0
238	Bituminous coal, Pocahontas	8	+3.0	5.4
25	Cotton	10	+3.3	5.8
202	Cotton yarns, cones 10/1	10	+3.7	6.2
217	Storm serge	8	+3.7	6.9
423	Sheetings, 10-4 Pepperell R	10	+3.8	6.2
203	Cotton yarns, cones 22/1	10	+4.2	6.9
269	Nails, wire	9	+4.2	5.8
182	Drillings, Mass. D.	10	+4.8	5.9

TABLE 38 (Cont.)

(1) Ref. No.	(2) Commodity	(3) No. of price recessions	(4) Average deviation from reference date (in months)	(5) Measure of inconsistency
192	Muslin, Rough Rider	10	+4.8	6.2
319	Poplar	9	+5.2	7.0
430	Tickings	10	+5.3	6.6
190	Muslin, Fruit of the Loom	10	+5.7	6.6
181	Drillings, Pepperell	10	+5.9	5.5
191	Muslin, Lonsdale	10	+6.0	6.1
206	Flannels, white	8	+6.0	2.1
197	Sheetings, 4-4 Pepperell	10	+6.3	7.0
180	Denims	10	+6.7	5.9
237	Bituminous coal, New River	8	+6.7	6.5
291	Screws, wood	10	+6.9	7.1
396	Glycerine	8	+7.0	4.7
193	Muslin, Wamsutta	9	+7.4	4.4
321	Spruce	9	+7.8	4.7
424	Sheeting, 10-4 Wamsutta	8	+8.0	5.0
183	Flannel, colored	8	+8.7	7.0
313	Pine, white boards	8	+9.1	5.5
196	Sheetings, 4-4 Indian Head	10	+9.2	6.2
312	Oak	9	+13.0	6.7

Of the commodities in the list of 66 which are most consistent during revival, 43 are among the 66 which are most consistent during recession. The degree of consistency is on the whole higher during recession, since the group representing this phase of the cycle all have measures of inconsistency less than 7.2 in value. (For the group shown in Table 28 the upper limit of the measure of inconsistency was 8.0.) Twenty eight of the 66 commodities (42.4 per cent of the total) moved before the general price index, on the average, while 38 lagged behind.

When the measures relating to average time of recession for the 66 series most consistent during recession are correlated with corresponding revival measures for the same articles, a coefficient of +.74 is secured.

A group of commodities still more compact in respect to their movements during recession is obtained by a further narrowing of the basis of selection. If we exclude all the exceptional commodities, all those which did not reflect all 10 recessions, and all those for which the measure of inconsistency was greater than 5.5, we have the commodities in the following list.

TABLE 39

SEQUENCE OF RECESSION IN THE PRICES OF A SELECTED GROUP OF COMMODITIES, WITH MEASURES OF INCONSISTENCY

(This table is restricted to the 20 commodities which were most consistent in their price movements during recession.)

(1) Ref. No.	(2) Commodity	(3) Average deviation from reference date (in months)	(4) Measure of inconsistency
42	Hides	—5.7	3.1
19	Sheep	—4.9	4.9
15	Hogs	—4.2	4.1
295	Copper, wire	—4.2	5.4
17	Sheep	—3.9	3.3
16	Hogs	—3.8	3.8
293	Copper, ingot	—3.7	5.4
259	Pig iron, basic	—2.2	4.8
261	Pig iron, foundry no. 2, northern	—2.2	4.1
263	Pig iron, foundry no. 2, southern	—2.0	4.5
276	Steel billets	—2.0	2.9
382	Tallow	—1.8	5.3
226	Silk, raw	—1.6	5.4
13	Cattle	—1.5	5.5
260	Pig iron, Bessemer	—1.1	3.7
158	Cottonseed oil	— .6	4.6
266	Bar iron	— .3	4.2
450	Rope	+ .3	3.7
236	Bituminous coal	+2.2	5.0
181	Drillings, Pepperell	+5.9	5.5

It is a rather peculiar feature of this list that only 3 of the 20 series (relating to 15 commodities) which are most consistent on recession lag behind the general price index. This reverses the situation depicted in Table 29 relating to revival. Thirteen of the 20 series most consistent on revival lagged behind the general index. The explanation of this may be found in the behavior of members of the metals group, with their tendency to lag on revival and lead on recession. The exceptional consistency of this group makes them dominate the two lists. The fact that the most consistent commodities lead on recession and not on revival suggests that the price conditions preceding recession are somewhat the same, from recession to recession, but that there is much less consistency in the conditions preceding revival. This requires much additional proof, however.

Eleven of the 20 series which are most consistent on revival are among the 20 which are most consistent on recession. These 11 (which include hides, hogs, tallow, cottonseed oil, copper wire, 4 pig iron quotations, steel billets and bar iron) constitute, therefore, the most generally consistent group among the commodities studied.

In summary, there is presented a list of those commodities which are particularly subject to cyclical fluctuations, ranked according to the consistency in the timing of their movements during recession. The list includes 84 commodities which passed through 9 cycles or more during the period from 1890 to 1925. The commodities classed as exceptional have been excluded.

TABLE 40

Cycles in Commodity Prices, at Wholesale

Ranking of Eighty Four Price Series according to the Consistency of their Movements during Business Recessions

(The commodities for which the measures in columns (4) and (5) are lowest are those which were most consistent in relation to the movements of the general price index during recession.)

(1) Ref. No.	(2) Commodity	(3) No. of cycles	(4) Measure of inconsistency in timing of recession (based on all entries but those for the 16th period)	(5) Measure of inconsistency in timing of recession (based on all entries)
276	Steel billets	10	2.9	4.5
179	Calico	9	3.0	3.6
42	Hides	10	3.1	3.2
17	Sheep, ewes	10	3.3	3.2
450	Rope	10	3.7	3.5
260	Pig iron, Bessemer	10	3.7	5.2
16	Hogs, light	10	3.8	3.8
15	Hogs, heavy	10	4.1	4.0
261	Pig iron, foundry no. 2, northern	10	4.1	5.3
221	Worsted yarns, 2-40's	9	4.1	4.0
266	Bar iron, Phila.	10	4.2	4.1
193	Muslin, Wamsutta	9	4.4	5.0
263	Pig iron, foundry no. 2, southern	10	4.5	5.2
158	Cottonseed oil	10	4.6	4.8
321	Spruce	9	4.7	4.7
259	Pig iron, basic	10	4.8	5.8
19	Sheep, wethers	10	4.9	4.7
289	Wire fence	9	5.0	6.3
236	Bituminous coal, Kanawha	9½	5.0	7.0
298	Quicksilver	9	5.0	4.8
382	Tallow	10	5.3	5.1
226	Silk, raw, Kansai No. 1	10	5.4	5.2
295	Copper, wire	10	5.4	6.4
293	Copper, ingot	10	5.4	6.7
13	Cattle, choice to prime	10	5.5	6.8
181	Drillings, Pepperell	9½	5.5	6.2
353	Turpentine	9	5.6	5.6
228	Silk, raw, extra-extra	10	5.6	5.4
294	Copper, sheet	9	5.7	7.3
269	Nails, wire	9	5.8	7.2
25	Cotton	9½	5.8	5.6
180	Denims	9½	5.9	6.6
182	Drillings, Mass. D	9½	5.9	6.0
64	Beef, fresh	10	6.0	5.8

TABLE 40 (Cont.)

(1) Ref. No.	(2) Commodity	(3) No. of cycles	(4) Measure of inconsistency in timing of recession (based on all entries but those for the 16th period)	(5) Measure of inconsistency in timing of recession (based on all entries)
191	Muslin, Lonsdale	10	6.1	5.8
440	Leather, sole oak	10	6.1	8.1
192	Muslin, Rough Rider	10	6.2	5.9
196	Sheetings, 4-4 Indian Head	9½	6.2	6.7
14	Cattle, good to choice	10	6.2	6.2
202	Cotton yarns, carded, cones 10/1	9½	6.2	6.2
423	Sheetings, 10-4 Pepperell	10	6.2	5.9
302	Zinc, slab	9	6.2	12.5
296	Lead, pig	10	6.4	7.5
69	Hams	10	6.5	6.8
190	Muslin, Fruit of the Loom	10	6.6	6.3
430	Tickings	9½	6.6	6.5
220	Worsted yarns, 2-32's	10	6.7	6.4
441	Leather, sole oak, scoured backs	9	6.8	6.8
203	Cotton yarns, carded, cones 22/1	10	6.9	6.9
319	Poplar	9	7.0	6.6
197	Sheetings, 4-4 Pepperell	10	7.0	7.4
362	Alcohol, wood	9	7.0	7.2
195	Print cloths	9½	7.0	6.9
433	Cottonseed meal	9	7.1	7.1
291	Screws, wood	9	7.1	8.5
68	Beef, salt	9	7.3	7.3
186	Ginghams, Lancaster	9	7.3	7.0
198	Sheetings, 4-4 Ware Shoals	9	7.4	7.1
300	Tin, pig	10	7.4	7.1
354	Lead, carbonate of	10	7.5	7.1
115	Mackerel	9	7.5	7.1
438	Leather, harness oak	9	7.5	7.1
239	Coke	10	7.6	8.2
47	Milk	10	7.6	7.3
267	Bar iron, Pittsburgh	10	7.7	7.9
185	Ginghams, Amoskeag	10	7.7	7.3
448	Jute	10	8.1	7.7
348	Linseed oil	10	8.1	7.7
139	Meal, corn, fine white	9	8.5	8.6
140	Meal, corn, yellow table	9	8.6	6.1
71	Mutton	10	8.8	8.6
74	Pork, cured, salt mess	10	8.8	8.4
436	Leather, calf	10	8.9	10.3
76	Pork, cured, short clear sides	9	8.9	8.6
350	Rosin	9	9.3	8.7
327	Brick	9	9.5	9.5
75	Pork, cured, rough sides	9	9.5	9.2
451	Rubber	9	9.9	9.6
130	Prunes	10	10.8	10.6
53	Rice	9	11.2	10.6
345	Glass, window, B	10	11.4	10.9
109	Coffee	10	11.4	11.8
344	Glass, window, A	9	12.1	11.5
397	Opium	9	12.2	11.7

In the computation of the measures of inconsistency given in column (4) of the above table, entries relating to the 16th period (centering at September, 1918) have been omitted, because of the influence of price regulation and war-time disturbances upon these entries. It is these measures which have been given in earlier tables. A second set of measures, in the computation of which all entries relating to recession have been employed, is given in column (5). These are comparable in all respects to the measures describing consistency of revival, which were given in Table 30. The ranking of commodities in Table 40 is based upon the entries in column (4), which are probably more representative than are those in the fifth column.

The measures of inconsistency in column (4) range from 2.9 for steel billets to 12.2 for opium, the mean value of the measures being 6.6. The measures in column (5) vary from 3.2 for sheep to 12.5 for zinc slab, with a mean value of 6.8. The limits and the averages are all lower than the corresponding measures in Table 30, relating to revival. This rough comparison indicates that price movements during recession are more consistent, from cycle to cycle, than are the movements of prices during revival. This hypothesis is tested more rigorously at a later point.

c. *Duration of Periods of Falling Prices.* The range of variation in respect to duration of periods of price recession is somewhat smaller than was the case with rising prices. When the fifteen representative commodities are ranked according to the duration of decline, we have the following arrangement.

TABLE 41

CYCLES IN COMMODITY PRICES, AT WHOLESALE

Ranking of Fifteen Commodities according to the Average Duration of the Period of Price Decline.

(1) Ref. No.	(2) Commodity	(3) Duration of price decline (in months)
13	Cattle	9.9
64	Beef	14.5
441	Leather	15.7
25	Cotton	16.5
247	Petroleum	16.7
239	Coke	17.2
202	Cotton yarns	18.3
280	Steel rails	18.6
195	Print cloths	19.0
451	Rubber	20.0
293	Copper, ingot	20.2
233	Anthracite coal	21.0
276	Steel billets	21.4
259	Pig iron	23.0
236	Bituminous coal	25.2

Corresponding measures for the six general economic series are given in Table 21. These vary from 12.3 months, for pig iron production, to 22.0 months, for the yield on railroad bonds. The ranking is, of course, just the reverse of that in Table 32, showing the average duration of rise. With the exception of the bond yield series the period of decline is much shorter than the period of rise.

In Table XVIII, in the Appendix, are given measures showing the average duration of periods of falling prices, for all the commodities studied. As in Table XVI, relating to periods of rise, the main entries are based upon all the periods of fall, whether extending over one or several general business cycles. Where the main entries are affected by periods of falling prices extending over more than one "normal" cycle, second averages are given in parentheses. These are based only upon such periods of fall as continued through but one phase of recession (and depression).

The duration of the average period of decline varies considerably, even though we restrict the study to commodities which reflected all the cycles in general business during the period under review. The smallest measure in this restricted group is that for cattle prices, for which the average period of decline lasted but 9.9 months. The longest average period of decline, 25.2 months, is found in the prices of bituminous coal.

The percentage relation of the average period of fall to the average length of the cycle may be determined directly from the figures in Table 33, for the commodities passing through 5 or more distinct cycles.

A final aspect of price behavior during recession is described by the figures showing the average percentages of decline. These appear in column (20) of Appendix Table XII. A ranking of commodities according to the magnitude of these percentages would be much the same as the ranking based upon the indexes of cyclical variability, shown in Table XIV.

5. RELATIONS AMONG MEASURES OF CYCLICAL PRICE MOVEMENTS

In the last section of this chapter the general relations among commodity price characteristics are discussed. It seems fitting to introduce at this point, however, a brief account of the relationships among the various measures of cyclical price movements. Correlation coefficients describing certain of these relations are given in the following table. The measures correlated are averages computed for individual commodities from entries relating to all observed cycles. There have been excluded from these calculations those commodities which have been classed as exceptional, and all those the prices of which passed through less than five complete cycles between 1890 and 1925. The commodities used in securing the following results numbered 149.[1]

TABLE 42

Correlation Coefficients Measuring the Relationships among Measures of Cyclical Price Movements*

(1) Measures correlated [The measures correlated are named below and in the headings of columns (2) to (8).]	(2) Index of cyclical variability	(3) Av. time of revival	(4) Av. time of recession	(5) Av. duration of rise	(6) Av. duration of fall	(7) Av. percentage of rise	(8) Av. percentage of fall
Index of cyclical variability		—.50	—.47	+.05	—.03		
Av. time of revival	—.50		+.72	—.40	+.43	—.43	
Av. time of recession	—.47	+.72		+.13	—.15	—.33	—.43
Av. duration of rise	+.05	—.40	+.13		—.76	+.19	
Av. duration of fall	—.03	+.43	—.15	—.76			—.01
Av. percentage of rise		—.43	—.33	+.19			
Av. percentage of fall			—.43		—.01		

*These coefficients are based on measures describing the average behavior of 149 commodities which passed through at least five complete cycles between 1890 and 1925. Twenty-six "exceptional" commodities have been omitted.

a. *Relations between Measures of Cyclical Variability and Other Cyclical Measures.* There is evidence of a fair degree of negative correlation between the amplitude of the cyclical movements in commodity prices and the average date of revival in prices after a period of depression. The coefficient has value of —.50. In interpreting this coefficient the signs employed in defining the dates of turn must be borne in mind. A negative sign is used when the date of turn precedes the date of turn in general prices, and a positive sign is used when the commodity lags behind the general price index. Thus the negative coefficient of correlation means that those commodities which rose first after depression were subject, in general, to wider cyclical fluctuations than were the commodities which lagged on revival. Since the prompt revival and the wide fluctuations are both evidence of sensitivity to cyclical changes, this relationship is a reasonable one.

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[1] These commodities include all those listed in Appendix Table X except the 26 which are there designated as exceptional, and those the numbers of which follow: Nos. 104, 106, 148, 166, 174, 199, 213, 214, 223, 232, 233, 234, 235, 244, 250, 254, 255, 271, 272, 273, 287, 338, 357, 381, 405, 406, 414, 422, 425, 428, 429, 431, 456, 457.

Approximately the same degree of correlation as was observed in the preceding case is found when the index of variability is correlated with the average date of the high point preceding recession. The coefficient is —.47. In general, those commodities which started the downward movement early were the ones marked by the widest fluctuations.

There appears to be no relation between the duration of the period of rise, or the duration of the period of fall, and the index of cyclical variability. The amplitude of the swings does not depend upon the duration of the period of rising or falling prices.

As has been noted, the above coefficients have been computed from measures which describe the *average* behavior of individual commodities. Would the same relationships be found if the entries relating to the behavior of individual commodities in individual cycles were correlated? This has been tested in respect to two of the relationships described above. The following results were secured.

TABLE 43

Correlation Coefficients Measuring the Relations between Cyclical Variability and other Cyclical Price Characteristics

(Based on measures describing the behavior of individual commodities in individual cycles)

(1) Series correlated with index of cyclical variability	(2) No. of observations	(3) Coefficient of correlation r	(4) $\frac{r}{\sigma_r}$
Time of revival	1110	—.29	10.1
Time of recession	1110	—.31	10.8

The measures which have been employed in deriving the above coefficients relate to the 149 commodity price series which entered into the computations upon which Table 42 is based. These coefficients correspond, therefore, to the entries in that table, differing only in that measures relating to individual cycles, and not averages, have been employed.

The coefficient of —.50, secured from the averages, is reduced to —.29 when the individual entries for dates of low and variability for individual cycles are correlated. The coefficient of —.47, relating to the averages of cyclical variability and dates of high, is reduced to —.31 when the individual entries are correlated. The evidence of a true relationship between the two pairs of variables is rather stronger, however, when the individual measures are used. The probable error of the coefficient is greatly reduced by the increase in the number of observations from 149 to 1110. As a result, the coefficients based upon the individual entries differ more significantly from zero than do the coefficients computed from the averages.

The measure $\frac{r}{\sigma_r}$ indicates the significance of the given value of r, as evidence of a true relationship. If this exceeds 2.58 it may be taken as definite proof that there is a real relationship between the series correlated.[1]

b. *Relations between the Time of Revival and Other Cyclical Measures.* The fact has already been noted that there is a considerable degree of similarity between the average sequence of price change during revival and the average sequence during recession. The coefficient of correlation, based upon 149 pairs of observations, is +.72.

There is a negative correlation between the average date of revival and the average duration of rise. Bearing in mind the significance of the signs relating to the timing of revival, this means that the commodities which turned upward in price first during revival had, in general, the longest period of rise. The degree of correlation is not high ($r = -.40$). There is some positive correlation ($r = +.43$) between the average duration of fall and the average date of the low point preceding revival. The commodities which experienced the longest periods of price decline have, on the average, risen in price later than those having shorter average periods of decline. The same degree of relationship, but one which is negative in sign ($r = -.43$), is found between the time of revival and the percentage of rise. The rise is, in general, somewhat greater for those commodities which start upward first.

As in the preceding case, it is advisable to determine the degree of correlation between the entries relating to individual cycles, as well as the relation between the averages for all cycles.

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[1] If the two variables were unrelated a coefficient of correlation which would cause the measure defined above to exceed 2.58 would be secured less than 1 time out of 100 trials.

TABLE 44

Correlation Coefficients Measuring the Relations between the Time of Revival and other Cyclical Price Characteristics

(Based on measures describing the behavior of individual commodities in individual cycles)

(1) Series correlated with time of revival in individual cycles	(2) No. of observations	(3) Coefficient of correlation r	(4) $\frac{r}{\sigma_r}$
Index of cyclical variability	1110	—.29	10.1
Time of succeeding recession	1202	+.27	9.7
Duration of succeeding period of rise	1110	—.36	12.8
Duration of preceding period of fall	1175	+.54	22.0
Percentage rise (rise expressed as percentage of ensuing high value)	1110	—.24	8.2

The above coefficients are all significant.[1] There is a definite positive correlation between the dates of revival and the dates of recession, though the coefficient is considerably lower than that based upon the average dates of revival and recession (+.27 as compared with +.72). In a given cycle the commodities which rise first in price during revival tend to reach their high point and decline in price at an early stage of the next period of recession. Although the correlation coefficient is not high it is equal to 9.7 times its standard error, and may be accepted as evidence of a true relationship. There is clear evidence, too, that those commodities which have risen first on revival have tended to undergo a longer period of rise, and to rise by somewhat greater relative amounts, than the commodities which have lagged on revival.

In correlating the measures of duration of decline and time of revival, each pair of observations has consisted of the period of decline, in months, and the date of the low point marking the culmination of that decline. There is a distinct positive correlation ($r = +.54$). This means that short falls are paired with early revivals, and long falls with late revivals, a result which is quite to be expected.

The coefficient given above as measuring the relation between dates of revival and dates of recession in individual cycles was based upon entries for specific low dates and succeeding high dates. The coefficient ($r = +.27$, with a standard error of .027) indicates a tendency for commodities which rose early in revival to decline at a relatively early date in the succeeding period of recession. Is there a similar tendency for commodities which decline early in recession to start the upward movement early in the succeeding period of revival? Another pairing of individual entries, with the date of low following the date of high, is called for. The correlation between these items (based upon 1192 individual entries) is measured by a coefficient of +.40, with a standard error of .024. This coefficient, which is high in comparison with its standard error, indicates a definite positive relation between the date of recession and the date of the succeeding revival in a given cycle. It is worthy of note that this relationship is significantly closer than that between the date of revival and the date of the succeeding recession. The order of price recession in a given cycle exercises a stronger influence upon the order of the succeeding revival than the order of revival exercises upon the order of the succeeding recession. There is evidence in both cases, however, of a significant relationship, and this is the fact to be stressed. Although each phase of a price cycle bears the imprint of novel factors, there are definite bonds which tie it to the phase that has preceded it.

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[1] Only those relationships which appeared to be significant, in the light of the work with averages, have been tested by means of the measures for individual cycles.

c. *Relations between the Time of Recession and Other Cyclical Measures.* Two of the measures in Table 42 defining the relation between the average date of recession and other cyclical movements have been commented upon above. The correlation between the date of recession and the average duration of rise is low (r = +.13) and not significant. The chief point of interest lies in the fact that this relationship is distinctly less pronounced than the corresponding relation between the duration of fall and the date of revival (r = +.43). The length of time during which a commodity has fallen in price bears some relation to the date (considered relatively, of course) when its price turns upward. The connection between the average period of rise and the time of recession is a much more remote one.

The relation between the average time of recession and the average duration of fall is also a slight one, but negative in character. There is a slight tendency for an early recession in prices to involve a period of recession longer than the average. This relationship (measured by a coefficient of —.15) is much less marked, however, than the corresponding relation between the average time of revival and the average duration of rise. An early up-turn in price has meant, in general, a period of rise longer than the average. (The correlation coefficient in this case has a value of —.40.)

The average time of recession is negatively correlated with both the average percentage of rise and the average percentage of fall. Commodities which decline in price early in recession tend to rise and fall by greater amounts than do the commodities which are affected somewhat later in a general price recession.

When the individual observations, instead of the averages, are paired, the following results are obtained. They are based upon entries relating to 149 commodities.

TABLE 45

CORRELATION COEFFICIENTS MEASURING THE RELATIONS BETWEEN THE TIME OF RECESSION AND OTHER CYCLICAL PRICE CHARACTERISTICS

(Based on measures describing the behavior of individual commodities in individual cycles)

(1) Series correlated with time of recession in individual cycles	(2) No. of observations	(3) Coefficient of correlation r	(4) $\frac{r}{\sigma_r}$
Index of cyclical variability	1110	—.31	10.8
Time of preceding revival	1202	+.27	9.7
Duration of preceding period of rise	1110	+.20	6.8
Duration of succeeding period of fall	1110	—.33	11.6
Degree of preceding rise (rise as percentage of high value)	1110	—.20	6.8
Degree of succeeding fall (percentage decline)	1118	—.36	12.9

The first two of these coefficients have been already commented upon. The measure of correlation between the individual observations relating to date of recession and duration of period of rise is positive, and somewhat higher than the correlation based on averages (+.20 as compared with +.13). The same tendency is indicated by the two measures—a tendency for long periods of rise to involve relatively late turns during recession. Similarly, an early downturn involves a relatively long period of decline, while a late downturn involves a shorter succeeding period of fall. This relationship is a necessary resultant of the fact that the sequence of revival, after depression, is not the same as the sequence of recession, after prosperity.

There is a negative correlation between the time of recession and the percentage of the preceding rise, and between the time of recession and the percentage of the succeeding fall. Those commodities which have risen by the greatest relative amounts tend to turn downward in price relatively early in recession. Similarly, the percentage of fall is generally greater for the commodities which have experienced an early recession.

d. *Relations among Other Measures of Cyclical Price Movements.* Most of the significant relations among measures of cyclical price movements have been touched upon above. The relatively high negative correlation between the average duration of rise and the average duration of fall ($r = -.76$) is, of course, to be expected. Given cycles of fairly constant length, those commodities with periods of rise longer than the average will have periods of fall shorter than the average. There is no significant relationship between the duration of the period of rise and the percentage of rise. (In interpreting this statement it must be remembered that the period of rise, as here defined, extends from the low point preceding revival to the high point preceding recession.) Similarly, there is no apparent relation between the average duration of price decline during recession and the average percentage of decline. A material decline may be abrupt or protracted.

e. *Consistency of the Sequence of Price Movements during Revival and Recession.* It has been established by certain of the measures presented in the preceding tables that the sequence of price movements during recession is not independent of the sequence of price changes during revival. A related subject of considerable interest remains to be investigated. This concerns the degree of consistency in the sequence of recovery during different periods of revival, and the degree of consistency in the sequence of recession in different cycles. Is there a common sequence of price movements which prevails, without much variation, from revival to revival. Is there a standard sequence of recession, a pattern to which different periods conform more or less closely?

There are several means by which the consistency of price movements during different periods may be tested. Dealing first with revival, we may measure the degree of relationship between the average time of price revival, for the commodities studied, and the times of revival during each of the cycles covered. The averages furnish a criterion, and the degree to which the sequence of revival during each cycle conforms to this criterion may be determined.[1]

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[1] For example, the average time of revival in pig iron prices during the 11 revivals studied was +5.1 (i. e. 5.1 months after the turn in the wholesale price index). The time of revival in pig iron prices in period 1 was +11. (See Table 19.) These two values, together with similar observations for 111 other commodities, made up the data from which the first coefficient in Table 46 was computed.

The coefficients defining these several relations are given in the following table. The price series employed include all those studied except 26 classed as exceptional[1] and 34 others which passed through less than 5 complete cycles between 1890 and 1925. In addition, those not sharing in a given price revival are excluded from the calculations for that period.

TABLE 46

CORRELATION COEFFICIENTS MEASURING THE RELATIONS BETWEEN THE AVERAGE TIME OF REVIVAL IN COMMODITY PRICE SERIES AND THE TIMES OF REVIVAL DURING SPECIFIC CYCLES

(1) Series correlated with average time of revival	(2) No. of observations	(3) Coefficient of correlation r	(4) $\frac{r}{\sigma_r}$
Time of revival, period 1 (May, 1892)*	112	+.28	3.0
Time of revival, period 3 (Mar., 1895)	116	+.46	5.5
Time of revival, period 5 (May, 1897)	149	+.73	12.9
Time of revival, period 7 (July, 1901)	129	+.48	6.2
Time of revival, period 9 (July, 1904)	130	+.58	8.0
Time of revival, period 11 (Feb., 1908)	130	+.65	9.7
Time of revival, period 13 (June, 1911)	129	+.56	7.6
Time of revival, period 15 (Nov., 1914)	145	+.51	7.1
Time of revival, period 17 (Feb., 1919)	124	+.30	3.5
Time of revival, period 19 (Jan., 1922)	142	+.46	6.1
Time of revival, period 21 (June, 1924)	105	+.50	5.8

*The reference date for each period is given in parentheses.

All these coefficients, which vary from +.28 to +.73, are significant, when judged with reference to their standard errors. The sequence of revival during the first period (for which the reference date was May, 1892) departed most widely from the average sequence. The coefficient is almost as low (+.30) for the 17th period (reference date February, 1919). The average sequence was approached most closely in period 5 (reference date May, 1897)[2] and in period 11 (reference date February, 1908). Although there are considerable variations in the degree of correlation from period to period, it is clear that there is a tendency for the sequence of revival to follow a common pattern during different cycles. It should be noted that the various coefficients are not fully comparable, because of variations in the number of commodities entering into the different calculations. This does not, however, invalidate the general conclusions reached.

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[1] See pp. 81,102 for an explanation of this classification.

[2] The relatively high coefficient for this period is in part due to the presence of exceptional cases, that is, commodities deviating widely from the mean in their up-turns. Such cases tend to distort the measure of correlation.

In making the above test we have correlated averages with individual measures of the time of revival, these individual items being taken by periods. In each case the item paired with a given average is one of the 11 items from which that average has been derived. Although the results are significant there is present a slight degree of spurious correlation. A somewhat different test which is not open to this criticism may be applied by correlating the dates of revival in successive cycles. That is, we may measure the degree of relationship between the timing of price movements in period 1 and in period 3, in period 3 and in period 5, and so on. Carrying these calculations through for the entries defining the sequence of revival, we secure the following measures.

TABLE 47

CORRELATION COEFFICIENTS MEASURING THE RELATIONS BETWEEN THE TIMES OF REVIVAL IN COMMODITY PRICES DURING SUCCESSIVE CYCLES

(1) Series correlated Times of revival in periods	(2) No. of observations	(3) Coefficient of correlation r	(4) $\frac{r}{\sigma_r}$
1 and 3 (May, 1892, Mar., 1895)[1]	92	+.06	.6
3 and 5 (Mar., 1895, May, 1897)	116	+.28	3.1
5 and 7 (May, 1897, July, 1901)	129	+.36	4.3
7 and 9 (July, 1901, July, 1904)	111	+.32	3.5
9 and 11 (July, 1904, Feb., 1908)	116	+.25	2.7
11 and 13 (Feb., 1908, June, 1911)	116	+.24	2.6
13 and 15 (June, 1911, Nov., 1914)	125	+.37	4.4
15 and 17 (Nov., 1914, Feb., 1919)	125	—.08	.9
17 and 19 (Feb., 1919, Jan., 1922)	121	+.27	3.0
19 and 21 (Jan., 1922, June, 1924)	100	+.29	3.0

[1] The reference dates for the two periods to which each coefficient relates are given in parentheses.

The coefficients defining the relations between price movements in successive phases of revival run materially lower than those given in Table 46. The measures in Table 47 vary from −.08 to +.37. The former coefficient measures the relation between the timing of revival in period 15 (reference date November, 1914) and in period 17 (reference date February, 1919). Not only was there no direct relation, but there was even a tendency toward negative correlation between the order of price revival following the outbreak of war and the order of revival during the first post-war boom. The highest coefficient is that of +.37, measuring the relation between the revival in period 13 (reference date June, 1911) and the revival in period 15 (reference date November, 1914). (A somewhat closer relationship, measured by a coefficient of +.41, is found between the revivals following the two major depressions of 1908 and 1921. This is based upon 126 entries.)

Although the measures listed in Table 47 are relatively low, 8 of the 10 coefficients there given are significant of real relationships between the timing of revival in successive cycles.[1] It is clear, on the other hand, that although there is a tendency to follow a common pattern during successive revivals, the departures from this common pattern are pronounced.

We may make similar tests of the consistency of price movements during recession. There are given in the following table measures of the degree of relationship between the times of recession in the prices of individual commodities in given cycles and averages of these times during ten periods of recession. The commodities included have been indicated in explaining Table 46.

TABLE 48

Correlation Coefficients Measuring the Relations between the Average Time of Recession in Commodity Price Series and the Times of Recession during Specific Cycles

(1) Series correlated with average time of recession	(2) No. of observations	(3) Coefficient of correlation r	(4) $\frac{r}{\sigma_r}$
Time of recession, period 2 (Feb., 1893)*	121	+.43	5.2
Time of recession, period 4 (Oct., 1895)	117	+.61	8.2
Time of recession, period 6 (Apr., 1900)	131	+.55	7.5
Time of recession, period 8 (Oct., 1902)	126	+.57	7.7
Time of recession, period 10 (Oct., 1907)	136	+.60	8.7
Time of recession, period 12 (Apr., 1910)	126	+.50	6.4
Time of recession, period 14 (Sept., 1913)	123	+.51	6.5
Time of recession, period 16 (Sept., 1918)†	126	+.39	4.7
Time of recession, period 18 (May, 1920)	149	+.57	8.4
Time of recession, period 20 (Apr., 1923)	121	+.51	6.5

*The reference date for each period is given in parentheses.

†In deriving the average times of recession used in the above calculations all entries relating to period 16, for which the reference date is September, 1918, were omitted. It was felt that price movements in this recession were so much affected by price regulation and other war-time disturbances that more representative averages could be secured by omitting them. A coefficient for period 16 has been worked out, however, and is included in the table. Although lower than any of the other figures, this coefficient is significant. In spite of the abnormal influences affecting this recession, there was some resemblance to the average sequence of change.

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[1] For each of these 8 cases the chance of securing the given coefficient, if there were no real correlation between the timing of revival in the periods in question, is less than 1 out of 100.

As in the case of revival, we find a tendency toward a common pattern in the sequence of recession. The variations are considerable, but in each of the periods here studied there is a significant relationship with the common criterion furnished by the averages.

Applying now the test based on a comparison of successive phases of recession, we secure the following measures.

TABLE 49

Correlation Coefficients Measuring the Relations between the Times of Recession in Commodity Prices during Successive Cycles.

(1) Series correlated Times of recession in periods	(2) No. of observations	(3) Coefficient of correlation r	(4) $\frac{r}{\sigma_r}$
2 and 4 (Feb., 1893, Oct., 1895)[1]	97	+.36	3.8
4 and 6 (Oct., 1895, Apr., 1900)	111	+.22	2.3
6 and 8 (Apr., 1900, Oct., 1902)	111	+.36	4.0
8 and 10 (Oct., 1902, Oct., 1907)	116	+.27	3.0
10 and 12 (Oct., 1907, Apr., 1910)	116	+.18	1.9
12 and 14 (Apr., 1910, Sept., 1913)	108	+.25	2.6
14 and 16 (Sept., 1913, Sept., 1918)	105	+.28	3.0
16 and 18 (Sept., 1918, May, 1920)	128	+.20	2.3
18 and 20 (May, 1920, Apr., 1923)	121	+.36	4.2

[1] The reference dates for the two periods to which each coefficient relates are given in parentheses.

The coefficients measuring the relation between price movements during the recession phases of successive cycles range in value from +.18 to +.36, the latter value occurring in three different pairings. (A relationship somewhat closer than that indicated by this maximum value is found between the major recessions of 1907 and 1920. The coefficient of correlation, based upon 136 entries, has a value of +.40 in this case.)

When account is taken of the sampling errors to which these measures are subject, we find that six of the nine coefficients relating to the timing of recession in successive cycles are indicative of real relationships. They confirm the evidence of the preceding measures in revealing a tendency toward a common sequence of movements during price recessions. Chance does not play alone in ordering the sequence of change during each recession. There is a regularity here that reveals the presence of constant factors, operating in recession after recession, factors which impress upon each cycle traces of a pattern which is found in other cycles.

There is a suggestion in the above coefficients that the common pattern is slightly more in evidence in the data relating to recessions than in the figures measuring the time of revival. That is, the sequence of price change during recessions appears to be slightly more consistent than the sequence of change during revivals. The average of the different coefficients given in each of the above tables dealing with recessions is slightly higher than the average of the corresponding measures relating to revival. A somewhat more accurate test of the relative consistency of price movements during recession and during revival may be made if we employ the measures of inconsistency for individual commodities which were explained in an earlier section. For any single commodity, it will be recalled, the measure of inconsistency relating to revival (or to recession) would be zero if its price moved with a constant lead or lag in reference to the wholesale price index. Hence, the lower the average of the measures of inconsistency for a given group of commodities, the less is the variation from cycle to cycle in sequence of price movements. When we combine the measures of inconsistency relating to the movements during revival and recession of the 84 most sensitive price series (i. e. those commodities which were not classed as exceptional and which passed through nine cycles or more during the period from 1890 to 1925), we secure the following figures.[1]

	Arithmetic mean	Standard deviation
Measures of inconsistency relating to revival	7.73	2.22
Measures of inconsistency relating to recession	6.85	2.14
Difference between means	.88	
Standard error of difference between means	.336	

The average of the recession measures is smaller than the average for revival, the difference between the two means being 2.61 times the standard error of the difference. As such a difference would arise because of sampling errors less than 1 time out of 100, there is evidence here that for this group of commodities the sequence of price movements during recession has been more consistent than the sequence of price changes during revival.

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[1] The measures of inconsistency here employed are based upon entries for all periods. If the measures relating to recession be those from which the first period of post-war recession (period 16) was excluded, a mean of 6.65 is secured, instead of the value of 6.85 given in the text.

The various coefficients presented in the preceding tables have shown that there are significant interrelations among the several measures relating to the timing, duration and amplitude of cyclical price movements. The individual measures have been derived, it will be recalled, by applying to more than two hundred price series a standardized procedure for measuring the changes in commodity prices which have accompanied cycles in general business. After the individual measures had been secured, tests of relationship were made. It is highly significant that these subsequent tests revealed the presence of a common pattern in these cyclical price movements. True regularities, which clearly reflect the influence of forces other than chance, are found in the cyclical movements of commodity prices.

V Relations Between Prices and Price-Determining Factors: Price Flexibility

In the four preceding sections certain general characteristics of commodity prices have been dealt with. In describing these attributes attention was concentrated on price changes, with no reference to specific factors which might have produced these changes. The present section is concerned with those movements in the prices of individual commodities which are related in some measurable way to specific economic factors. We are concerned, that is, with the general problem of price determination, though certain aspects only of this broad subject can be considered in the present study.

This section differs from those which have preceded it in that no compilation of measures relating to a number of commodities is attempted. A brief account is given of methods which have been developed elsewhere, and several examples are included as illustrations of procedure. So much is necessary in any complete account of measures of price behavior. A collection of measures of the type here described, suitable in quality and quantity for a study of group behavior, waits upon the future.

1. Measures Needed in Defining the Relationship Between Prices and Price-Determining Factors

In studying the factors affecting the price of any commodity we are working upon an old problem, that of defining the relationship between variable quantities. In this case the dependent variable is the price of the commodity in question. There may be one or many independent variables—the quantity (of this commodity) produced, the stocks held over from a preceding year, the quantity consumed, the price of a substitute, the general level of prices, and so on without limit, if all related factors were to be considered. In general, of course, the study must be confined to a limited number of the most important price-determining factors.

The measures necessary to a definition of the relationship in question are those which are required in every study of relations between variable quantities, with two rather important additions. The basic measures, apart from these additions, are an equation which defines the functional relationship between the price of the commodity in question and the chief factors which affect this price, a measure of the reliability of this equation (the standard error of estimate), and an abstract measure of the degree of relationship between the price of the commodity in question and the factors affecting this price, considered severally or collectively (the coefficient or index of correlation, simple, partial, or multiple). These customary measures may, in the study of price determination, be supplemented by two important additional measures, the coefficient of determination and the coefficient of price flexibility.

The coefficient of determination is a statistical device[1] which is particularly appropriate for use in problems of price determination. It is a measure of the proportion of the squared variability of the dependent variable which may be attributed, on the assumption of a causal relationship,[2] to one or more independent variables. In the simple case, where only two variables are concerned, the coefficient of determination is equal to the square of the coefficient of correlation. Its derivation under other conditions is discussed in the references cited.

The coefficient of flexibility, as defined by Henry L. Moore,[3]

[1] The original presentation may be found in an article on "Correlation and Causation," by Sewall Wright, in the *Journal of Agricultural Research*, January, 1921, pp. 557-585. An account of this measure is given by B. B. Smith in "Forecasting the Acreage of Cotton," *Journal of the American Statistical Association*, March, 1925, pp. 31-47.

[2] The name of the coefficient indicates the assumption that the fluctuations in the dependent variable are in some part *determined* by fluctuations in the independent variable. Whether this assumption is or is not valid must be determined, of course, upon the basis of other evidence than the purely statistical relationship. In problems of price determination there is generally ample justification for assuming such a causal connection, a fact which validates the general use of the coefficient of determination in such investigations.

[3] "Elasticity of Demand and Flexibility of Prices," *Journal of the American Statistical Association*, March, 1922.

may be *simple* or *partial*, using these terms as they are employed in respect to measures of correlation. The simple coefficient, which is based upon the relation between the price of a given commodity and the quantity of that commodity marketed, is given by the expression

$$\phi = \frac{x}{y} \cdot \frac{dy}{dx} = \frac{d \log y}{d \log x}$$

where y represents price and x represents quantity. The coefficient of flexibility is the ratio of the relative change in the price, per unit of commodity, to the corresponding relative change in the quantity, when the relative changes are infinitesimal.[1] This function measures the rate of variation in the price of a commodity as the quantity factor varies. It may be taken as an index of the sensitivity of price to changes in quantity. By convention, taken over from Marshall's[2] treatment of elasticity of demand, the price of a commodity is considered to be *flexible* if ϕ is numerically greater than 1, *inflexible* if ϕ is numerically less than 1.

From the above definition it follows, of course, that the flexibility of price of a given commodity cannot be determined until an equation, describing the functional relation between prices and

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[1] The measure of elasticity of demand, the concept of which is perhaps more familiar, is analogous to the measure of price flexibility. The coefficient of elasticity of demand may be derived when quantity is the dependent variable and price the independent variable. It is given by the expression

$$\eta = \frac{y}{x} \cdot \frac{dx}{dy}$$

where x represents quantity and y price. The coefficient of elasticity of demand is the ratio of the relative change in the quantity demanded to the relative change in the price.

A problem of major importance in this field relates to the method of deriving the equation of relationship between prices and quantities. When prices (represented by the symbol y) are taken as dependent, quantity (x) being treated as the independent variable, it is assumed that all the "errors" (using that word in the sense in which it is employed in connection with the theory of least squares) are in y. When quantity is treated as the dependent variable it is assumed that all the "errors" are in x. It is customary to make the first assumption when the flexibility of prices is to be measured, and to make the second assumption when the coefficient of elasticity of demand is sought. Inconsistent values of these two coefficients will be secured by these processes (except when the relationship between prices and quantities is a perfect one). If consistent values of η and ϕ are required, as in most cases which arise in practice, it is necessary that some method of fitting should be employed in which allowance is made for the likelihood of errors in both variables. Such a method has been employed by Dr. Henry Schultz in his investigation of the elasticity of demand for sugar, and this general problem is discussed in detail in his work "The Statistical Law of Demand as Illustrated by the Demand for Sugar," *Journal of Political Economy*, October, December, 1925.

[2] Alfred Marshall stated the problem of determining elasticity of demand in this particular form, but the concept and the rigorous definition of terms date back to Cournot (*Researches into the Mathematical Principles of the Theory of Wealth*). Recent substantial progress in improving the technique of attack upon this important and difficult problem is due largely to the work of Henry L. Moore.

quantities, has been derived. This equation may be of any appropriate type. For most curve types the flexibility of prices for a given commodity will not be constant, but will vary from point to point on the curve. It is desirable, for the purpose of general comparison and grouping, to have for each commodity a single measure of price flexibility. This end is served if we can describe the relationship between prices and quantities by a curve for which the flexibility is constant. This is true of curves described by equations of the type $Y = aX^b$. Such a function may be cast into the logarithmic form

$$\log Y = \log a + b (\log X).$$

By definition, the coefficient of flexibility is equal to $\frac{d \log y}{d \log x}$. Hence for an equation of this type the coefficient of price flexibility is equal to the constant b in the equation of relationship.

As an alternative to the employment of this type of demand curve, a single measure of flexibility may be secured by measuring the flexibility at a single point on the curve, selecting that point which represents an approximation to average conditions. This may be done, if quantity is represented by ratios (i. e. link ratios or trend ratios), by finding the flexibility at that point on the curve for which the quantity ratio has a value of 1.0.

In a recent contribution[1] Henry L. Moore has materially broadened the concept of price flexibility, and has sharpened the tools of attack. This advance was made in introducing the concept of partial flexibility of prices (and partial elasticity of demand) as a natural development of the theory of multiple and partial correlation. As means of correcting for the influence of complicating factors and reducing to comparable terms coefficients of price flexibility for different commodities, measures of partial flexibility are of particular importance from the viewpoint of the present study.

§Coefficients of Partial Flexibility of Prices

A given price may, of course, be expressed as a function of several independent variables. Thus the price, X_1, of a given commodity may be expressed as a function of three variables, X_2, X_3 and X_4, by means of an equation of the type

$$X_1 = a + b_{12.34} X_2 + b_{13.24} X_3 + b_{14.23} X_4$$

where $b_{12.34}$ is the coefficient of net regression of X_1 on X_2, $b_{13.24}$ is the coefficient of net regression of X_1 on X_3, etc. In other words, $b_{12.34}$ measures the weight given to X_2 in estimating X_1, when account is also taken of the variables X_3 and X_4 in making the estimate. Professor Moore has shown how, from these coefficients of net or partial regression, coefficients of partial flexibility of price may be obtained.

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[1] "Partial Elasticity of Demand," *Quarterly Journal of Economics*, May, 1926.

The simple coefficient of price flexibility is given by the expression $\phi = \frac{x}{y} \cdot \frac{dy}{dx},$ where y represents price and x quantity. The coefficient of partial flexibility, when there are four variables, represented by the symbols employed above, is defined as follows:

$$\phi_{12\cdot34} = \frac{x_2}{x_1} \cdot \frac{\partial x_1}{\partial x_2}$$

The coefficient $\frac{x_2}{x_1} \cdot \frac{\partial x_1}{\partial x_2}$ measures the partial flexibility of X_1 with respect to X_2, when X_1 is expressed as a function of X_2, X_3 and X_4. By similar means, the partial flexibility of X_1 with respect to each of the other variables may be determined. The method may be extended to take in any number of variables, following precisely the analogy of partial correlation.

The problem in a given case is to determine the values of the various coefficients of partial flexibility. The simplest assumption, as Professor Moore points out, is to assume that ϕ is a constant. This assumption leads us, in attempting to measure simple flexibility, to use an equation of the form

$$\log Y = \log a + b (\log X).$$

If this type of equation be employed, the coefficient of flexibility is equal to the constant b, the coefficient of regression. In attempting to measure the partial flexibility of price, with respect to each of a number of independent variables, this assumption leads us to employ an equation of the form

$$\log X_1 = \log a + b_{12\cdot34} \log X_2 + b_{13\cdot24} \log X_3 + b_{14\cdot23} \log X_4.$$

(This may be extended, of course, to include any number of variables.) If this be done we have, for the coefficient of partial flexibility,

$$\phi_{12\cdot34} = \frac{x_2}{x_1} \cdot \frac{\partial x_1}{\partial x_2} = b_{12\cdot34}$$

similarly

$$\phi_{13\cdot24} = b_{13\cdot24}$$

All the coefficients of partial flexibility of prices may be derived in a similar fashion. If quantity, instead of price, be used as the dependent variable in an equation of the above type, the coefficients of partial elasticity of demand are identical with the corresponding coefficients of net regression.

2. RELATION BETWEEN THE PRICE AND PRODUCTION OF HAY IN THE UNITED STATES

Data suitable for a simple illustration of some of the measures we have discussed are shown in the following table. Here are given figures for the production of tame hay in the United States, by years, from 1890 to 1925, the average annual (crop year) wholesale prices of hay in Chicago over the same period, corresponding values of an index of wholesale prices[1] and, finally, deflated hay prices. The latter figures have been obtained by dividing the actual prices by the general index. This process eliminates, in a rough fashion, the effect upon hay prices of changes in the purchasing power of money.

The price and quantity data may be cast into several forms in studying the relationship with which we are here concerned. The simplest form, and one which has much to commend it, is that of link relatives. That is, the observations relating to prices and quantities in a given year are expressed as percentages of the corresponding observations for the year preceding. These link relatives appear in columns (3) and (7) of Table 50.

Points corresponding to the paired link relatives are plotted in Figure 8. It is obvious that there is a relationship between year-to-year changes in the total production of tame hay in the United States and year-to-year changes in the deflated price of hay at Chicago. This relationship is described by the following measures. (The symbol Y represents the link relatives of prices, while X represents the link relatives of production.)

Equation of relationship: $\log Y = 3.93434 - .96454 \log X$
Standard error of estimate in logarithmic form = .04643
Standard error of estimate in percentage form = 10.7
Coefficient of correlation = —.73
Coefficient of determination = .53
Coefficient of price flexibility = —.96

The standard deviation of the logarithms of the price relatives, which may be compared with the standard error of estimate, is .06753 (in percentage form 15.6). The graph of the equation of relationship appears in Figure 8.

These various measures furnish a fairly accurate description of the relationship which prevailed, from 1890 to 1925, between the production of hay in the United States and the price of hay in Chicago. The equation gives a precise statement of the average relationship. The reliability of estimates made from this equation is measured by the standard error of estimate in percentage form, which has a value of 10.7 per cent. That is, the true price should differ from the estimated price by not more than 10.7 per cent, in approximately 68 per cent of all cases. The coefficient

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[1] The wholesale price index of the U. S. Bureau of Labor Statistics has been averaged by crop years for the period 1900-1925. For the years 1890-99, for which it is given only on an annual basis, approximate crop year values have been derived by averaging successive calendar years.

TABLE 50

Prices and Production of Hay in the United States, with Index of Wholesale Prices, 1890-1925
(crop years)[1]

(1) Year	(2) Production tame hay (unit=1000 short tons)	(3) Link rel. of production	(4) Wholesale price per short ton (Timothy No. 1, Chicago) crop year average	(5) Index of wholesale prices (U. S. B. of L. S.) crop year average	(6) Deflated hay price, crop year average	(7) Link rel. of deflated price
1890	60,198		$10.96	80.5	$13.61	
1891	60,818	101.0	12.39	77.5	15.99	117.5
1892	59,824	98.4	11.47	76.0	15.09	94.4
1893	65,766	109.9	10.42	73.0	14.27	94.5
1894	54,874	83.4	10.62	69.5	15.28	107.1
1895	47,079	85.8	11.97	68.5	17.48	114.4
1896	54,380	115.5	8.81	67.0	13.15	75.2
1897	58,878	108.3	8.57	68.5	12.52	95.2
1898	66,772	113.4	8.53	72.5	11.77	94.0
1899	57,450	86.0	11.00	78.0	14.10	119.8
1900	53,231	92.6	12.31	78.9	15.60	110.6
1901	55,819	104.9	12.92	81.3	15.89	101.9
1902	65,296	117.0	12.83	86.7	14.79	93.1
1903	68,154	104.4	11.69	84.8	13.78	93.1
1904	69,192	101.5	11.50	86.1	13.36	96.9
1905	72,973	105.5	11.20	86.7	12.92	96.7
1906	66,341	90.9	15.87	91.2	17.40	134.7
1907	72,261	108.9	15.14	91.6	16.53	95.0
1908	78,440	108.5	12.04	93.0	12.95	78.3
1909	74,384	94.8	15.34	101.6	15.10	116.6
1910	69,378	93.3	18.24	95.2	19.16	126.9
1911	54,916	79.1	21.77	96.0	22.68	118.4
1912	72,691	132.4	16.77	100.1	16.75	73.8
1913	64,116	88.2	16.38	99.0	16.55	98.8
1914	70,071	109.3	15.93	99.8	16.12	97.4
1915	85,920	122.6	17.12	110.5	15.49	96.1
1916	91,192	106.1	16.58	151.8	10.92	70.5
1917	83,308	91.3	24.99	186.7	13.39	122.5
1918	76,660	92.0	31.67	199.9	15.84	118.3
1919	86,359	112.6	35.01	227.0	15.42	97.4
1920	87,855	101.7	28.80	183.8	15.67	101.6
1921	82,458	93.8	23.29	142.3	16.37	104.4
1922	95,748	116.1	21.97	155.7	14.11	86.2
1923	89,250	93.2	25.79	150.3	17.16	121.6
1924	98,086	109.9	22.84	154.8	14.76	86.0
1925	86,474	88.2	24.60	155.7	15.80	107.1

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[1] Production figures are those given in the Yearbooks of the Department of Agriculture. Prices are averages for crop years running from July to June. Thus the entry for 1890 is an average of the prices prevailing during the 12 months, July, 1890, to June, 1891.

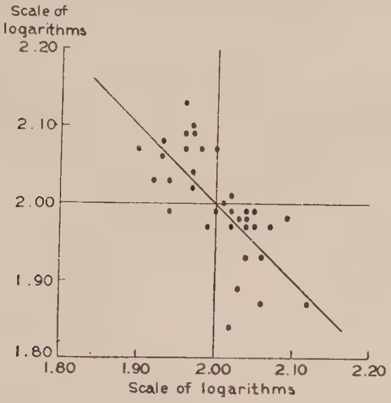
of correlation (between logarithms of link relatives of prices and production) has a value of —.73, with a probable error of .054. There is here a fair degree of correlation.

The coefficient of determination, which is equal to .53, may be interpreted in this fashion: On the assumption that there is a causal relation between fluctuations in the price of hay and variations in the total amount produced, we may say that 53 per cent of the variability of price is due to variation in production, variability being here measured in terms of the standard deviation squared. The remaining variability, 47 per cent of the original squared variability, is due to other factors which have not been included in the present analysis.[1]

FIGURE 8

DIAGRAM SHOWING THE RELATION BETWEEN THE WHOLESALE PRICES OF TAME HAY AND THE TOTAL PRODUCTION OF TAME HAY IN THE UNITED STATES.

Logarithms of Link Relatives of Deflated Prices (Crop Years) and of Production, 1890-1925, with Line of Average Relationship.*



*The equation to the line is: $\log Y = 3.93434 - .96454 \log X$. Prices are plotted on the vertical axis.

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[1] If we represent by σ^2_y the squared variability of the original observations on the dependent variable, by S^2_y (the square of the standard error of estimate) the squared variability which remains to be explained after account has been taken of the influence of the independent variable, and by $\sigma^2_y{}'$ the square of the standard deviation of the computed values of the dependent variable (i. e. the y-values of those points on the line of regression which correspond to the actual observations), it may be shown that $\sigma_y^2 = \sigma^2_y{}' + S_y^2$. (For a proof of this relationship see B. B. Smith, *Correlation Theory and Method Applied to Agricultural Research*, a mimeographed publication of the U. S. Bureau of Agricultural Economics.) The coefficient of determination may be derived from the relationship

$$d_{yx} = \frac{\sigma^2_y{}'}{\sigma^2_y}$$

(Footnote continued on next page.)

3. RELATION BETWEEN THE PRICE AND PER CAPITA CONSUMPTION OF POTATOES IN THE UNITED STATES

Another illustration, which affords an example of a commodity which is very flexible in price, is furnished by the following data.

TABLE 51

PRICES AND ESTIMATED PER CAPITA CONSUMPTION OF POTATOES IN THE UNITED STATES, 1890-1913
(crop years)[1]

(1) Year	(2) Estimated consumption, U. S. (in millions of bushels)	(3) Per capita consumption (in bushels)	(4) Link rel. of per capita consumption	(5) Wholesale price per bushel, crop year average	(6) Link rel. of wholesale price
1890	155.5	2.47		$.923	
1891	255.7	3.97	160.7	.326	35.3
1892	168.0	2.56	64.5	.717	219.8
1893	197.2	2.94	114.8	.588	82.0
1894	184.6	2.70	91.8	.596	101.3
1895	316.6	4.55	168.5	.203	34.0
1896	271.1	3.82	83.9	.224	110.5
1897	191.6	2.65	69.4	.584	260.9
1898	218.7	2.97	112.1	.411	70.4
1899	259.6	3.47	116.8	.370	90.0
1900	247.4	3.25	93.6	.384	103.7
1901	205.7	2.64	81.2	.750	195.2
1902	293.4	3.70	140.1	.435	58.0
1903	264.7	3.27	88.4	.811	186.4
1904	351.3	4.25	130.0	.315	38.8
1905	279.8	3.32	78.1	.565	179.5
1906	330.3	3.85	116.0	.457	80.9
1907	322.1	3.68	95.6	.614	134.2
1908	309.6	3.47	94.3	.786	128.0
1909	393.9	4.34	125.1	.376	47.8
1910	346.9	3.76	86.6	.484	128.8
1911	305.2	3.26	86.7	1.025	211.7
1912	418.9	4.40	135.0	.491	47.9
1913	333.4	3.45	78.4	.654	133.3

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[1] Total consumption has been estimated by adding to the total U. S. production during a given year all imports during the fiscal year ending June 30th following, and subtracting all exports during the same fiscal year.

The wholesale prices employed are those quoted by the U. S. Bureau of Labor Statistics for "ordinary to fancy" white potatoes. Crop year averages are based upon monthly prices, from September to May.

It is clear from this formula that this coefficient measures the proportionate relationship between the squared variability of the computed values (i. e. the variability which has been accounted for) and the squared variability of the original observations. That d_{yx} is equal to r^2_{yx} may be readily demonstrated from the following relationships:

$$\sigma^2_y = \sigma^2_{y'} + S^2_y$$

$$r^2 = 1 - \frac{S^2_y}{\sigma^2_y}$$

In the present problem the various measures of squared variability, in logarithmic form, have the following values:

$$\sigma^2_{\log y} = .00456009$$
$$\sigma^2_{\log y'} = .00215574$$
$$S^2_{\log y} = .00240435$$

The prices employed are those given in the wholesale price bulletins of the Bureau of Labor Statistics. The quotations are drawn from the Chicago market. These have been averaged by crop years (September to May).[1] Since changes in the price level were not so pronounced over the period here covered as they were during the period to which the preceding example related, and since deflation by a general index of wholesale prices furnishes only an approximation to the desired result, no attempt has been made to deflate these prices.

The link relatives are plotted in Figure 9, together with the graph of an equation describing the average relation between prices and production. The basic measures appear below. The symbol Y represents the link relatives of prices and X represents the link relatives of per capita consumption.

Equation of relationship: $\log Y = 6.43050 - 2.21193 \log X$
Standard error of estimate in logarithmic form = .09022
Standard error of estimate in percentage form = 20.9
Coefficient of correlation = —.938
Coefficient of determination = .8808
Coefficient of price flexibility = —2.21

The standard deviation of the logarithms of the price relatives, which may be compared with the standard error of estimate, is .26128 (in percentage form, 63.8).

During the period 1890-1913 there appears to have been a fairly close relation between the per capita consumption and the wholesale price of potatoes. The coefficient of determination has the relatively high value of .88. We may interpret this in the usual fashion, remembering that the consumption figures represent, in fact, potato production, corrected for imports and exports and for changes in the total population.

The demand for potatoes appears to be quite inelastic ($\eta = -.45$, approximately),[2] while the price is very flexible ($\phi = -2.21$). In

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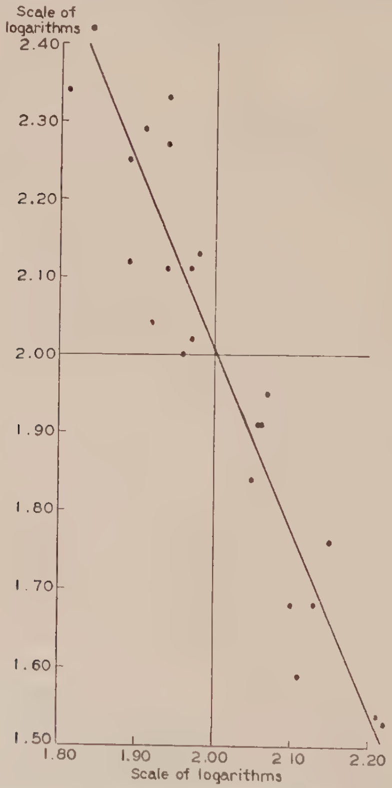
[1] The estimates of per capita consumption are, of course, only approximations. No account has been taken of loss in storage, which in some years may be considerable. For a detailed discussion of this general subject see "Factors Affecting the Price of Minnesota Potatoes," by Holbrook Working (*Technical Bulletin No.* 29, University of Minnesota, Agricultural Experiment Station). It is probable that the absolute production figures used in making these estimates were affected somewhat by a change in the basis for estimating yield per acre, in 1902. (See Working, p. 18.) By the use of link relatives the disturbing effect of such a change is restricted to one year, when the new method was put into operation.

[2] Holbrook Working, in his comprehensive study of the demand for potatoes, has expressed the relationship between price and consumption by means of another function,

FIGURE 9

DIAGRAM SHOWING THE RELATION BETWEEN THE WHOLESALE PRICES OF POTATOES IN CHICAGO AND THE PER CAPITA CONSUMPTION OF POTATOES IN THE UNITED STATES.

Logarithms of Link Relatives of Actual Prices (Crop Years) and of Per Capita Consumption, 1890-1913, with Line of Average Relationship.[1]



[1] The equation to the line is: $\log Y = 6.43050 - 2.21193 \log X$. Prices are plotted on the vertical axis.

this respect potatoes differ significantly from hay, which was treated above.

One important precaution should be mentioned in thus setting up for comparison the measures which have just been secured. The

which gives varying elasticities of demand. His values for η range from .36 at the highest prices to .49 in the middle ranges and .57 at the lowest prices. His price data are drawn from the St. Paul market, a different period is covered, and the original price and consumption data are modified, before correlating, by a method quite different from that followed here. The correlation between his corrected price and consumption data is given as .972. ("The Statistical Determination of Demand Curves," *Quarterly Journal of Economics*, August, 1925, pp. 503-543.)

immediate object of the present investigation is not the study of price-making forces which affect individual commodities, but the derivation of a set of measures relating to the characteristics of specific commodity prices and capable of comparison and combination with similar measures relating to other commodities. The emphasis throughout has been on such comparisons. Of the measures discussed above in surveying relations between prices and quantities, three are abstract coefficients which would appear to be suitable for this purpose. These are the coefficients of correlation, determination and flexibility.

The use of these coefficients in making comparisons and in forming combinations introduces difficulties which were not encountered in using the measures described in earlier sections. Each of the earlier measures—of variability, trend, cyclical behavior—described a characteristic of a given price series, considered by itself. But the values of the coefficients of correlation, determination and flexibility depend upon the relations between given price series and quantity series. If the coefficients relating to different commodities are to be compared we must be sure not only that the price series used are comparable, but that the quantity series employed are also comparable, and that the technical methods, by which the original price and quantity series have been adjusted and combined, permit valid comparison of the results. The conditions which would insure perfect comparability are difficult to secure and, accordingly, comparisons of coefficients of flexibility of price and elasticity of demand (and of the related measures discussed above) must always be made with great caution.[1]

VI Relations Among Commodity Price Characteristics

In the preceding sections there have been presented a number of measures descriptive of the behavior of individual commodity prices. It is of interest to determine whether the characteristics described by these several measures are related to each other in any consistent fashion. Such relations have been tested in a few cases, in connection with the preceding discussion. The following tables have been drawn up for the purpose of summarizing these and certain other relations.

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[1] E. J. Working after analyzing the conditions which affect the significance of a statistical demand or supply curve, suggests four points upon which information must be had before such a curve may be properly interpreted. These points concern (1) the relative variability of supply or demand curves in a given instance (Working means, by the variability of a supply or demand curve, tendency to shift back and forth from time to time), (2) the market to which the price and quantity data refer, (3) the extent to which "other things are held equal," and (4) the presence or absence of correlation between the shifting of supply and demand curves. Although the statistical significance of all these points has not been fully determined, Working's general discussion, and his emphasis upon a knowledge of all relevant details in interpreting results secured in this field, bear immediately upon the subject of price flexibility, which is the object of our present concern. (See "What do Statistical 'Demand Curves' Show?", E. J. Working, *Quarterly Journal of Economics*, February, 1927, pp. 212-235.)

TABLE 52

Correlation Coefficients Measuring the Relations between Year-to-Year Variability and other Characteristics of Individual Commodity Prices

(1) Series correlated with measure of year-to-year variability[1]	(2) No. of observations	(3) Coefficient of correlation
Measure of monthly variability	206	+.70
Measure of frequency of change (monthly)	206	+.58
Average annual rate of increase	206	+.27
Index of cyclical variability	149	+.79

[1] The measures correlated in the first three cases here listed were derived from prices for the period 1890-1913 (1896-1913 for the measures of rates of increase). The fourth entry was computed from measures relating to the period 1890-1924, for year-to-year variability, and 1890-1925, for cyclical variability.

The relations between the measures of year-to-year variability and the measures of monthly variability and frequency of change have already been noted. A fairly high positive correlation between the year-to-year variability and the cyclical variability is to be expected. The coefficient of correlation has a value of +.79.[1]

The relation between the year-to-year variability and the average annual rate of increase is significant for, although the coefficient is low, it is equal to more than four times its standard error. The phenomena are not independent. During the pre-war years to which these measures relate, the commodities which had the steepest price trends tended to be more variable in price than those with less pronounced trends. (This furnishes no proof, of course, of a causal connection between these factors.[2])

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[1] The coefficient +.79 is based, it should be noted, upon data relating to 149 commodities. It was deemed advisable to limit the comparison to this group, which included all those commodities (except 26 which were markedly irregular in their cyclical movements) which passed through five or more complete cycles between 1890 and 1925, in order that the measure of cyclical variability might be significant in all cases. All the correlations into which measures of cyclical behavior enter are based upon this restricted group.

[2] In measuring year-to-year variability an attempt has been made (by measuring deviations from the means of annual link relatives) to eliminate the effects of those changes in price which represent direct trend movements. It is probable, however, that these effects have not been entirely removed, a fact for which allowance must be made in interpreting the above coefficient.

In the following table the relations between monthly variability and certain other characteristics are summarized.

TABLE 53

CORRELATION COEFFICIENTS MEASURING THE RELATIONS BETWEEN MONTHLY VARIABILITY AND OTHER CHARACTERISTICS OF INDIVIDUAL COMMODITY PRICES

(1) Series correlated with measure of monthly variability[1]	(2) No. of observations	(3) Coefficient of correlation
Measure of year-to-year variability	206	+.70
Measure of frequency of change (monthly)	206	+.73
Average annual rate of increase	205	+.30[2]
Index of cyclical variability	149	+.90
Average time of revival	149	—.51
Average time of recession	149	—.45
Average duration of rise (i. e. average interval between date of low and date of high)	149	+.05
Average percentage of rise	149	+.85

[1] The measures correlated in the first three cases here listed were derived from prices for the period 1890-1913 (1896-1913 for the measures of rates of increase). The remaining entries were computed from measures relating to the period 1890-1925.

[2] In deriving this coefficient, measures relating to one highly variable commodity, onions, were omitted.

All these coefficients, with the exception of that which has a value of .05, are significant of real relationships.[1] There is a high correlation between the monthly variability and the cyclical variability, as there is, also, between the monthly variability and the average percentage of price rise during periods of revival and prosperity. The commodities which are most variable from month to month are subject to wider cyclical swings than are those which are fairly stable in price from month to month.[2] The coefficients measuring the relations between monthly variability and average dates of low and high indicate that the commodities which are more variable in price tend to rise earlier in revival and to fall earlier in recession than those which are more stable in price. (In interpreting the above coefficients of —.51 and —.45 it must be remembered that the time measure of a price movement prior to the reference date has a negative sign.) It is significant that there is no apparent connection between the variability of commodity prices and the duration of the period of rise.

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[1] With respect to the third item in this table allowance must be made for the influence of trend factors upon the measures of monthly variability. See p. 41.

[2] It should be noted that in measuring cyclical variability in the present study no attempt was made to isolate cyclical fluctuations. Accordingly, the index of cyclical variability is not free from the influence of seasonal and accidental movements, both of which affect the values of the monthly variability measures.

The following table gives the results secured when measures of frequency of price change are paired with measures of various other characteristics of commodity prices.[1]

TABLE 54

CORRELATION COEFFICIENTS MEASURING THE RELATIONS BETWEEN THE FREQUENCY OF MONTHLY PRICE CHANGE AND OTHER CHARACTERISTICS OF INDIVIDUAL COMMODITY PRICES.

(1) Series correlated with measure of frequency of monthly price change*	(2) No. of observations	(3) Coefficient of correlation
Measure of year-to-year variability	206	+.58
Measure of monthly variability	206	+.73
Average annual rate of increase	206	+.36
Index of cyclical variability	149	+.72

*The measures correlated in the first three cases here listed were derived from prices for the period 1890-1913 (1896-1913 for the measures of rates of increase). The fourth entry was computed from measures relating to the period 1890-1925.

In addition to the relations previously commented upon, it may be noted that there are significant positive relationships between the frequency of price change and the average annual rate of increase, and between the frequency of price change and the index of cyclical variability.

In a final table measures of the relations between pre-war price trends and other price characteristics are presented.

TABLE 55

CORRELATION COEFFICIENTS MEASURING THE RELATIONS BETWEEN THE AVERAGE ANNUAL RATES OF INCREASE AND OTHER CHARACTERISTICS OF INDIVIDUAL COMMODITY PRICES

(1) Series correlated with average annual rate of increase*	(2) No. of observations	(3) Coefficient of correlation
Measure of year-to-year variability	206	+.27
Measure of monthly variability	205	+.30†
Measure of frequency of price change	206	+.36
Measure of cyclical variability	147	+.17
Average time of revival	149	—.16
Average time of recession	149	+.02

*All rate of increase measures entering into these calculations are based upon prices for the years 1896-1913. The measures of year-to-year variability, monthly variability and frequency of change are derived from prices for the years 1890-1913. The measures of cyclical variability, time of revival and time of recession relate to cycles occurring between 1897 and 1913.

†In deriving this coefficient, measures relating to one highly variable commodity, onions, were omitted.

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[1] Coefficients measuring the correlation between indexes of frequency of price change and other variables must be discounted somewhat, since the frequency distributions of the measures of frequency of change depart materially from the normal type. U-shaped distributions are secured when these measures are combined. A detailed account of these and other distributions of measures of price behavior is given in Chapter IV.

In discussing the first three of these measures in preceding sections it has been pointed out that, although the coefficients are low, there is evidence of a significant relationship between the degree of variability of commodity prices and the pre-war trends of these prices. The first of the measures listed above is equal to 4.3 times its standard error, the second to 4.7 times that measure, while the third is 6.1 times its standard error.[1]

In computing the last three measures in Table 55 averages relating to cyclical behavior during the five cycles which occurred between 1897 and 1913 have been paired with the measures of rates of increase between 1896 and 1913. During this period there was no apparent relation between the average time of recession and the rate of increase. There is some indication that commodities with the sharpest rates of increase tended to rise in price early, during revival, but the coefficient (—.16) is equal only to 2.01 times its standard error, and does not furnish conclusive evidence on this point. Similarly, there is a suggestion that commodities with the steepest trends were subject to price cycles of wider amplitude than those which rose at lower rates, but again the evidence is not conclusive. The coefficient (+.17) is equal to 2.12 times its standard error.

VII Summary

As a first step in the study of price behavior a number of measures describing characteristics of the prices of individual commodities have been computed. In addition to price relatives of the customary type there have been discussed in this chapter measures of variability and trend, measures relating to the behavior of individual commodity prices during cycles in general business, and measures descriptive of the relations between the prices and quantities of specific commodities. These measures furnish raw materials for the study of prices in combination and for the analysis of the price system. For this reason, and because of their probable utility to those interested in particular commodities and in commodity markets, the results have been presented in considerable detail.

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[1] There is reason to suspect that these positive correlations are wholly or in part due to the influence of farm products, which as a group are highly variable in price, and which, during the several decades prior to the war, were increasing in price at rates well above the average. When farm products are excluded there remain 182 articles. For these commodities the correlation between the average annual rate of price increase and the year-to-year variability of prices is +.23. This coefficient is smaller than the measure for all commodities, but must still be adjudged significant of a real relationship, since it is more than three times as great as its standard error. An identical figure is secured when the average annual rate of increase is correlated with the measure of monthly variability.

1. Three indexes of price variability have been employed in the present study. One of these measures the amplitude of monthly price fluctuations, another measures the frequency of monthly price changes, and a third measures the amplitude of year-to-year movements.

a. As a measure of monthly price movements within each year the mean deviation from the average price for the year has been employed. Such a measure, in both absolute and relative form, has been computed for each commodity for each year from 1890 to 1925, employing wholesale price quotations. (The number of commodities varies, in different years, from 204 to 214.) Commodity averages secured from these annual measures have been used in the general study of price behavior.

b. The index of year-to-year variability is the mean deviation of link relatives, computed from average annual prices. The years from 1890 to 1913 are covered by one set of computations, while another includes the period 1890-1924. Measures of this type have been obtained for 206 commodities at wholesale, for 13 foods at retail, and for 8 agricultural products, employing prices at the farm.

c. The ratio of the number of changes in the price of a given commodity to the total number of months, less one, for which price quotations on that commodity are available, furnishes the index of frequency of price change. The maximum value of the ratio is unity, indicating a change in price every month during the period covered, and the minimum value is zero. Such a measure has been computed for each of 206 commodities for each eight-year period from 1890 to 1921, and for the four-year period from 1922 to 1925. Price quotations at wholesale have been employed.

2. A study of the annual measures of monthly price variability during the 24 years preceding the war (1890-1913) reveals a definite tendency toward a decline in the variability of commodity prices during this period. The measures of frequency of price change show a less pronounced movement in the same direction.

Both sets of measures indicate that the variability of prices was greater during the years from 1922 to 1925 than during the 8 years preceding the war. The influence of war-time disturbances upon individual prices appears to have persisted, rendering post-war prices more variable than the prices which prevailed during the years immediately preceding the war.

3. The trends of commodity prices have been expressed as average annual rates of increase or decrease over a stated period. The period employed for this purpose covers the years from 1896 to 1913, during which the general level of wholesale prices in the United States was rising at a fairly constant rate from year to year. Differences in the trends of individual prices during this period represent shifting economic relations which are of considerable economic importance. A measure of this type has been computed for each of 223 commodity price series, at wholesale.

Measures of rates of change in the per unit purchasing power of individual commodities (in terms of other commodities at wholesale) have been derived from the measures of rates of change in prices.

4. The study and comparison of price trends suggests certain conclusions concerning relations between commodity prices. It is assumed in many discussions that there is a certain "normal" relation between the prices of individual commodities and commodity groups, and that this relation is disturbed during such price disturbances as were brought by the war. The present evidence indicates that there was no normal pre-war relation between prices, in their absolute form. What was constant in the pre-war price situation was not a set of fixed price differences, but relations which changed at fairly regular rates year by year. To assume that the actual prices in a given year stand in a normal relation to each other is to attempt to crystalize a cross-section of a constantly changing situation.

5. In measuring the timing, duration and amplitude of individual price changes during price cycles there have been secured eight measures descriptive of the movements of each of 209 individual price series during each of the ten cycles which occurred between 1890 and 1925. These measures are:

Date of low point preceding price revival (expressed as a deviation in months from the date of the low of the wholesale price index of the Bureau of Labor Statistics)

Duration of rise during revival and prosperity
Percentage of rise during revival and prosperity
Date of high point preceding recession (expressed as a deviation in months from the date of the high of the wholesale price index of the Bureau of Labor Statistics)
Duration of decline during recession and depression
Percentage of decline during recession and depression
Duration of cycle
Amplitude of cyclical movement

These have been averaged and correlated in various ways in the detailed study of price behavior.

6. A number of significant relationships among the measures of cyclical price movements have been observed.

a. The commodities which rise first on revival are subject, in general, to wider cyclical fluctuations than are the commodities which lag on revival. Similarly, the commodities which decline first on recession are marked by wider fluctuations than are those which lag.

b. The commodities which rise first during revival tend to decline first on recession, but the correlation between the sequence of change on revival and the sequence of change on recession is far from perfect.

c. When measures relating to individual cycles are paired, it is found that the correlation between the timing of recession and the timing of revival on the next succeeding turn is significantly higher than the correlation between the timing of revival and the timing of the following recession. The order of price recession in a given cycle exercises a stronger influence upon the order of the succeeding revival than the order of revival exercises upon the order of the succeeding recession. There is evidence in both cases, however, of a significant relationship. Although each phase of a price cycle bears the imprint of novel factors, there are definite bonds which tie it to the phase that has preceded it.

d. There is a clear tendency for the sequence of revival to follow a common pattern during different cycles. The same tendency is observed in studying the sequence of recession in different cycles. The common pattern is slightly more in evidence for the data relating to recession than in the figures measuring the time of revival. Other evidence bears out this suggestion that the consistency of price movements during different periods of recession is greater than it is during revival.

7. The evidence upon which the preceding statements are based is of considerable general significance in showing that there are true economic regularities in the price movements which accompany cycles in general business. In cycle after cycle there has been observed a degree of uniformity in the sequence of revival and recession in commodity prices and in other aspects of price behavior. If cyclical movements represented the play of mere variability about a mean or a trend, one would expect the sequence of price change in each cyclical swing to be unique, except for certain chance resemblances to movements at other times. Yet the odds against chance alone accounting for the regularities we have found are infinitely great. In period after period there is a recurrence of price movements which have something in common, in respect to sequence of change, amplitude and duration. These changes in different periods are far from showing perfect uniformity, but there is unmistakable evidence that the observed resemblances would not be found if the cyclical movements of individual prices represented random fluctuations alone. The phenomena of business cycles show just those regularities and uniformities which it is the business of the scientist to discover, trace and, if he can, explain.

8. During the pre-war years there was some correlation between the variability of commodity prices and the slopes of their lines of trend. The commodities having the steepest trends tended to be more variable in price than those with less pronounced trends. (This conclusion must be qualified somewhat because the different measures of variability are in varying degree affected by changes in price which represent direct trend movements.)

9. Five measures have been used in studying the relations between the prices of specific commodities and various price-determining factors. These are:

a. An equation of average relationship
b. A measure of the reliability of this equation (the standard error of estimate)
c. The coefficient of correlation
d. The coefficient of determination

e. The coefficient of price flexibility, which measures the sensitivity of the price of a commodity to changes in quantity

In the treatment of this aspect of price behavior the inadequacy of the data render it impossible to secure measures relating to a considerable number of price series. Accordingly, only a few illustrative examples have been included in this section of the report.

In assembling and discussing the measures described in the present chapter the emphasis throughout has been upon differences between *commodities* in respect to price behavior. We now proceed to a discussion of differences between *markets* in respect both to absolute prices and to the behavior of prices.

CHAPTER II

REGIONAL DIFFERENCES IN COMMODITY PRICES AND IN PRICE BEHAVIOR

In the use of current index numbers of prices we are accustomed to treat very large geographical areas as units. Thus half a dozen American index numbers of wholesale prices purport to measure price changes in the United States, and they are currently interpreted as indexes which represent wholesale price movements in the country as a whole. Such an interpretation is valid if the movements of general prices are equal in degree and synchronous in time, or nearly so, over the entire country. Or it may be valid, even though the movements of prices in different parts of the country differ somewhat, if we look upon the index as an average for the country as a whole. In this case the index should be so constructed that the different geographical areas are properly represented in the list of price quotations employed. In the absence of proof that price movements are uniform throughout the country, careful regional sampling is essential in the construction of a general index number.[1]

The data for a systematic study of regional price differences within a single country are not at present available. It is possible in the present section, therefore, to do no more than suggest a method and present a few scattered results indicating the magnitude of these regional differences.

Two general divisions of such a study have been named in the title of this chapter. The first is a study of the actual price differences prevailing at given dates. Certain commodities are standardized in price throughout the country, while others differ in price from market to market. In the degree of variation found at a given time in the quotations for a single homogeneous commodity is found an important characteristic of that article. Again comparable price quotations drawn from different regions throw light on the size and character of the market for a given commodity, and facilitate study of the problem of competitive price.[2]

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[1] Practically all the price quotations entering into Dun's index number and into Fisher's weekly index number relate to the New York market. The quotations employed by the Bureau of Labor Statistics are drawn from different markets, but there is no attempt at systematic regional sampling.

[2] A very effective device for portraying regional price differences has been employed by Holbrook Working ("Factors Determining the Price of Potatoes in St. Paul and Minneapolis," *Technical Bulletin No.* 10, University of Minnesota, Agricultural Experiment Station). This is an *isotimic map*, which shows lines of equal price, just as an isothermal map shows lines of equal temperature.

The other phase of this investigation relates to the behavior of commodity prices in different regions. Differences in the degree of price change between specific dates, differences in variability, trend differences, differences in the timing, duration and amplitude of cyclical movements, differences in flexibility—all these would be studied in a comprehensive survey of price behavior in different countries or in different sections of a single country. It is highly probable on *a priori* grounds that differences in economic and other cultural conditions will be accompanied by significant differences in the behavior of commodity prices.

I Regional Differences in Prices

As a measure of regional price differences the *mean deviation*, in absolute form and as a percentage of the mean, has been employed. The data utilized relate to the wholesale prices of certain building materials and gasoline, retail prices of a number of foods, coal, gas and electricity, and dry goods, and farm prices of certain agricultural products. For purposes of comparison similar measures of regional differences in discount rates have been computed.

1. Regional Differences in Wholesale Prices

a. *Building Materials.* In studying regional differences in the prices of building materials, prices paid by contractors in various cities have been employed.[1] For the purpose of the present example prices of six commodities, at four different dates, have been utilized. The dates to which the prices relate mark the approximate turning points of general building material prices, as measured by the group index of the United States Bureau of Labor Statistics.[2] The cities represented vary in number from 16 to 24.[3]

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[1] The prices, which relate to materials delivered on the job, are compiled by the Division of Building and Housing of the Bureau of Standards. They appear in a monthly mimeographed release of the U. S. Department of Commerce.

[2] The values of this building materials index, at important turning points, were as follows:

March, 1922	154.6
April, 1923	204.3
July, 1924	168.8
Feb., 1925	182.8

The base of these relatives is the average for 1913.

[3] These cities include Pittsburgh, Erie, Cleveland, Akron, Toledo, Lorain, Dayton, Detroit, Bay City, Saginaw, Waterloo, Kansas City, Sioux Falls, San Antonio, Tucson,

The measures relating to the individual commodities are summarized in Table 56, on the next page.

Certain rather curious differences between commodities are revealed in this table. One would expect the degree of variation to increase, if measured in absolute terms, as the average increases. For four of the six commodities listed above just the reverse is true. At the dates when prices were lowest the absolute measures of regional difference were greatest for Portland cement, pine boards, lime and building sand. With common brick the absolute differences from city to city are least with low prices, and greatest with high prices. Wire nails show conflicting tendencies in this respect.

No definite conclusions concerning the relation between regional differences and the scale of absolute prices should be drawn from these quotations, however. The prices employed relate to but four dates. More detailed figures which are given at a later point indicate a relationship which is not quite so simple as that suggested by the data in Table 56.

In comparing commodities the relative measures of regional difference given in column (4) should be employed. Although the cities from which price quotations were drawn were not precisely the same for the six commodities listed, it is not probable that the rather slight differences in this respect have any material effect on the relative measures given in this table, nor on the averages derived from them.

In general, the tendency has been for the degree of regional difference to decline since the date of the low point in general building material prices in 1922. This is true of all the above commodities except common brick.

On the basis of the averages given in column (4) of Table 56, Portland cement appears to be most uniform in price among the cities included, while building sand is least uniform. Reasons for

Spokane, Portland, Ore., Baltimore, Fairmont, Columbia, Savannah, Shreveport, New London, Poughkeepsie, Albany, Rochester, Buffalo.

Each of these cities is represented in the quotations for the commodities mentioned, except for the following omissions:

Common brick: Erie, Toledo, Spokane.
Portland cement: Toledo, Kansas City, Spokane.
Pine boards: Erie, Toledo, Dayton, Detroit, Saginaw, Spokane, Baltimore, Savannah, Albany, Rochester, Buffalo.
Lime: Waterloo, Kansas City, Tucson, Spokane, New London.
Building sand: Kansas City, Sioux Falls, Spokane, Portland, Ore., Albany, Buffalo.
Wire nails: Erie, Cleveland, Toledo, Lorain, Bay City, Sioux Falls, Portland, Ore., Savannah, Shreveport, Albany, Rochester.

TABLE 56

Measures of Regional Differences in Building Material Prices

(1) Date	(2) Mean price per unit	(3) Regional price difference (mean deviation)	(4)
		Absolute	Relative
	A. Common brick (24 cities) (Unit: 1000 brick)		
April 1, 1922	$15.48	$1.95	12.6
May 1, 1923	18.88	3.09	16.4
August 1, 1924	17.88	2.41	13.5
March 1, 1925	17.80	2.42	13.6
Average			14.0
	B. Portland cement (24 cities) (Unit: barrel)		
April 1, 1922	$ 2.77	$ .38	13.4
May 1, 1923	3.47	.26	7.5
August 1, 1924	3.10	.29	9.3
March 1, 1925	3.10	.29	9.3
Average			9.9
	C. Pine, common boards, no. 1, 1x6 (16 cities) (Unit: 1000 feet)		
April 1, 1922	$39.69	$8.79	22.1
May 1, 1923	49.00	8.06	16.4
August 1, 1924	43.62	7.26	16.6
March 1, 1925	45.25	7.94	17.5
Average			18.1
	D. Lime, hydrated (22 cities) (Unit: ton)		
April 1, 1922	$18.61	$2.95	15.8
May 1, 1923	19.87	2.72	13.7
August 1, 1924	19.41	2.58	13.3
March 1, 1925	19.78	2.45	12.4
Average			13.8
	E. Building sand (21 cities) (Unit: cubic yard)		
April 1, 1922	$ 2.21	$ .60	27.1
May 1, 1923	2.35	.45	19.1
August 1, 1924	2.25	.47	20.9
March 1, 1925	2.29	.40	17.5
Average			21.1
	F. Wire nails (16 cities) (Unit: keg)		
April 1, 1922	$ 3.89	$.56	14.4
May 1, 1923	4.50	.70	15.5
August 1, 1924	4.24	.47	11.1
March 1, 1925	4.26	.61	14.3
Average			13.8

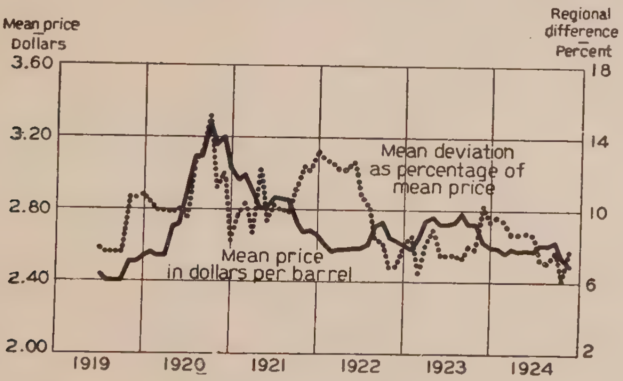
these varying results do not concern us now. Differences in transportation charges, regional differences in the availability of supplies, differences in producing and marketing conditions, and differences in the intensity of competition would interact in various ways to produce the differences noted.

It is possible to make a more detailed study of regional differences in the prices of Portland cement. Monthly quotations on this commodity for a number of cities are given in *Mineral Resources of the United States*, published by the United States Geological Survey. Wholesale prices in ten cities,[1] as given by months for the period from July, 1919, to December, 1924, have been employed in computing the measures given in Table 57.

The average monthly price and the mean deviation, in cents, are plotted in the accompanying graph.

FIGURE 10

AVERAGE MONTHLY PRICES AND MEASURES OF REGIONAL DIFFERENCES IN THE PRICES OF PORTLAND CEMENT, AT WHOLESALE, IN TEN AMERICAN CITIES, 1919-1924.



The figures and the graph show the rise in Portland cement prices to a high in 1920, the break late in that year, the gradual recovery in 1922 and 1923, and the moderate recession in price during 1923 and 1924. The measures of regional difference have varied materially during this period. Two periods of relatively wide regional price variation stand out. The first of these came at the peak of cement prices in 1920. The immediate effect of the ensuing decline in average prices was a sharp diminution in the degree of regional difference. This was due, presumably, to a more abrupt

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[1] Atlanta, Boston, Denver, Detroit, Kansas City, Los Angeles, New York, Pittsburgh, San Francisco, Seattle.

TABLE 57

Average Monthly Prices with Measures of Regional Differences in the Prices of Portland Cement, at Wholesale, in Ten American Cities, 1919-1924

(Unit: barrel)

(1) Month	(2) Mean price	(3) Regional difference (mean deviation) Absolute	(4) Regional difference (mean deviation) Relative	(5) Mean price	(6) Regional difference (mean deviation) Absolute	(7) Regional difference (mean deviation) Relative
		1919			1920	
January				$2.54	$.274	10.8
February				2.56	.268	10.4
March				2.54	.252	9.9
April				2.54	.252	9.9
May				2.71	.265	9.8
June				2.72	.272	10.0
July	$2.44	$.190	7.8	2.89	.275	9.5
August	2.40	.184	7.6	3.09	.393	12.7
September	2.40	.184	7.6	3.10	.409	13.2
October	2.40	.184	7.6	3.28	.498	15.2
November	2.51	.266	10.6	3.16	.354	11.2
December	2.51	.266	10.6	3.20	.386	12.1
		1921			1922	
January	3.02	.247	8.2	2.65	.350	13.2
February	2.96	.288	9.7	2.60	.334	12.8
March	2.99	.307	10.2	2.56	.322	12.5
April	2.89	.251	8.7	2.57	.314	12.2
May	2.80	.339	12.1	2.57	.314	12.2
June	2.81	.261	9.3	2.58	.326	12.6
July	2.87	.294	10.3	2.58	.279	10.8
August	2.86	.285	10.0	2.60	.267	10.2
September	2.85	.281	9.8	2.71	.231	8.5
October	2.73	.302	11.1	2.73	.220	8.1
November	2.67	.331	12.4	2.65	.181	6.8
December	2.68	.325	12.1	2.62	.181	6.9
		1923			1924	
January	2.60	.211	8.1	2.59	.241	9.3
February	2.58	.219	8.5	2.58	.248	9.6
March	2.64	.170	6.4	2.56	.239	9.3
April	2.74	.223	8.1	2.58	.221	8.6
May	2.76	.246	8.9	2.57	.222	8.6
June	2.72	.202	7.4	2.58	.224	8.7
July	2.72	.202	7.4	2.57	.222	8.6
August	2.73	.204	7.5	2.60	.186	7.1
September	2.78	.204	7.3	2.60	.183	7.0
October	2.72	.218	8.0	2.62	.202	7.7
November	2.72	.211	7.8	2.53	.153	6.0
December	2.62	.267	10.2	2.49	.192	7.7

decline in those markets in which prices had been exceptionally high than in those in which the price of the commodity had been below the average. This sharp decline in the measure of regional difference lasted only three months. Although the average price continued to fall for more than a year thereafter, the degree of regional difference increased irregularly after January, 1921.

The second period of high values in the measure of regional variation extended from November, 1921, to June, 1922. During this period the average price of cement reached its lowest point, following the recession of 1920-1922. The increase in the average price that began in April, 1922, brought a pronounced decline in the regional differences, the measure falling to a level slightly lower than that prevailing at the opening of the period here covered, in July, 1919. During 1923 and 1924 both the average price and the measure of regional difference fluctuated within comparatively narrow limits.

No general conclusions concerning the relation between changes in the average price of a commodity and variations in the degree of regional price difference may be drawn from a study of this one series. It is highly probable that extensive study would reveal important differences between commodities in this respect. The data in the next section portray a relationship differing materially from that illustrated above.

b. *Gasoline.* Gasoline is another commodity sufficiently standardized to permit a study of regional price differences. In the present analysis wholesale gasoline prices prevailing in fifty cities at seven different dates have been employed.[1] The results of the study are given in the following table.

TABLE 58

AVERAGE WHOLESALE PRICES AND MEASURES OF REGIONAL DIFFERENCES IN THE PRICES OF GASOLINE IN FIFTY CITIES AT SEVEN DATES

(1) Date	(2) Mean price per gallon (in cents)	(3) Regional price difference (mean deviation) Absolute (in cents)	(4) Relative
May, 1920	27.7	1.47	5.3
January, 1922	22.5	1.88	8.3
April, 1923	21.5	1.89	8.8
June, 1924	18.3	1.76	9.6
August, 1925	19.1	1.82	9.5
January, 1927	17.2	1.94	11.3
October, 1927*	14.5	1.78	12.2

*These measures are based upon quotations for 49 cities. A figure was not available for Crawford, Nebraska.

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[1] The quotations are wholesale tank wagon prices, exclusive of tax (where a tax is levied), as published in the *National Petroleum News*. The prices used are those given

In May, 1920, at the peak of general prices, gasoline prices were higher than at any of the other dates recorded above. (This was not the actual high of gasoline prices in 1920, however.) Regional differences, whether measured in absolute or relative terms, were at a minimum. By January, 1922, the average price had declined 5 cents a gallon, but the degree of regional difference had materially increased. The absolute measure of regional differences is fairly stable after that date, but the relative measure increases with declining average prices. In October, 1927, with the average price at the lowest here recorded, the relative measure of regional difference was at its maximum, values being more than twice as great as during the high prices of 1920. There is apparent here a tendency toward greater regional uniformity at high prices than at low, but with observations for only seven dates the precise relationship cannot be determined.

A more detailed story is furnished by the following measures. These have been computed from monthly tank wagon gasoline

in that publication for the date nearest the first of the month. The following cities are represented:

Standard Oil N. J. Territory
Newark, N. J.
Baltimore, Md.
Washington, D. C.
Richmond, Va.
Wheeling, W. Va.
Charlotte, N. C.
Charleston, S. C.
Columbia, S. C.

Standard Oil N. Y. Territory
New York, N. Y.
Albany, N. Y.
Buffalo, N. Y.
Boston, Mass.

Atlantic Refining Territory
Pittsburgh, Pa.
Philadelphia, Pa.
Providence, R. I.
Hartford, Conn.

Standard Oil Ky. Territory
Lexington, Ky.
Birmingham, Ala.
Atlanta, Ga.
Savannah, Ga.

Continental Oil Territory
Denver, Colo.
Butte, Mont.
Salt Lake City, Utah
Albuquerque, N. M.
Boise, Idaho

Standard Oil Ind. Territory
Chicago, Ill.
Indianapolis, Ind.
Detroit, Mich.
Madison, Wis.
Minneapolis, Minn.
Des Moines, Iowa
St. Louis, Mo.
Fargo, N. D.

Standard Oil Nebraska Territory
Crawford, Nebr.
Omaha, Nebr.

Standard Oil Cal. Territory
Los Angeles, Cal.
San Francisco, Cal.
Portland, Ore.
Seattle, Wash.
Spokane, Wash.
Tacoma, Wash.

Standard Oil La. Territory
Little Rock, Ark.
New Orleans, La.
Shreveport, La.
Nashville, Tenn.
Memphis, Tenn.

Magnolia Petroleum Territory
Oklahoma City, Okla.
Dallas, Texas
El Paso, Texas
Fort Worth, Texas

prices at wholesale, in the ten cities represented by the cement figures in Table 57. Data from these cities alone were utilized in order that the results for cement and gasoline might be comparable.

TABLE 59

AVERAGE MONTHLY PRICES WITH MEASURES OF REGIONAL DIFFERENCES IN THE PRICES OF TANK WAGON GASOLINE, AT WHOLESALE, IN TEN AMERICAN CITIES, 1919-1927

(Unit: gallon)

(1) Month	(2) Mean price (in cents)	(3) Regional difference (mean deviation) Absolute	(4) Regional difference (mean deviation) Relative	(5) Mean price (in cents)	(6) Regional difference (mean deviation) Absolute	(7) Regional difference (mean deviation) Relative
		1919			1920	
January	23.1	1.54	6.6	23.3	1.43	6.1
February	23.3	1.66	7.1	24.3	1.71	7.0
March	23.3	1.66	7.1	24.6	1.94	7.9
April	23.3	1.66	7.1	26.6	1.93	7.3
May	23.3	1.66	7.1	26.8	2.10	7.8
June	23.4	1.74	7.5	27.5	2.44	8.9
July	23.5	1.58	6.7	27.6	2.53	9.2
August	23.5	1.58	6.7	27.6	2.53	9.2
September	23.1	1.22	5.3	29.3	1.83	6.2
October	23.1	1.22	5.3	29.3	1.83	6.2
November	23.1	1.22	5.3	29.3	1.83	6.2
December	23.1	1.22	5.3	29.2	1.77	6.1
		1921			1922	
January	29.0	1.54	5.3	22.5	2.23	9.9
February	27.1	1.70	6.3	21.7	1.26	5.8
March	25.5	1.71	6.7	21.7	1.26	5.8
April	24.8	1.27	5.1	21.7	1.26	5.8
May	24.7	1.41	5.7	22.6	1.62	7.1
June	22.9	2.11	9.2	23.9	2.11	8.8
July	22.1	1.74	7.9	24.0	2.21	9.2
August	21.8	2.09	9.6	22.9	1.51	6.6
September	20.9	1.80	8.6	22.3	1.51	6.8
October	20.8	1.94	9.3	22.3	1.51	6.8
November	22.4	1.77	7.9	20.2	1.69	8.3
December	22.9	2.47	10.8	19.9	1.81	9.0
		1923			1924	
January	19.5	1.41	7.2	13.1	1.66	12.7
February	19.2	1.73	9.0	16.5	2.20	13.3
March	20.6	2.30	11.1	18.0	1.80	10.0
April	20.4	2.69	13.2	18.0	1.80	10.0
May	19.1	2.79	14.6	18.0	1.80	10.0
June	19.2	1.95	10.2	18.0	1.80	10.0
July	19.2	1.95	10.2	17.0	2.20	12.9
August	18.0	2.59	14.4	16.4	1.72	10.5
September	15.7	2.46	15.7	16.0	1.40	8.8
October	14.6	2.83	19.4	14.1	.57	4.1
November	13.1	2.14	16.4	13.6	.68	5.0
December	12.4	1.70	13.8	13.4	.94	7.0

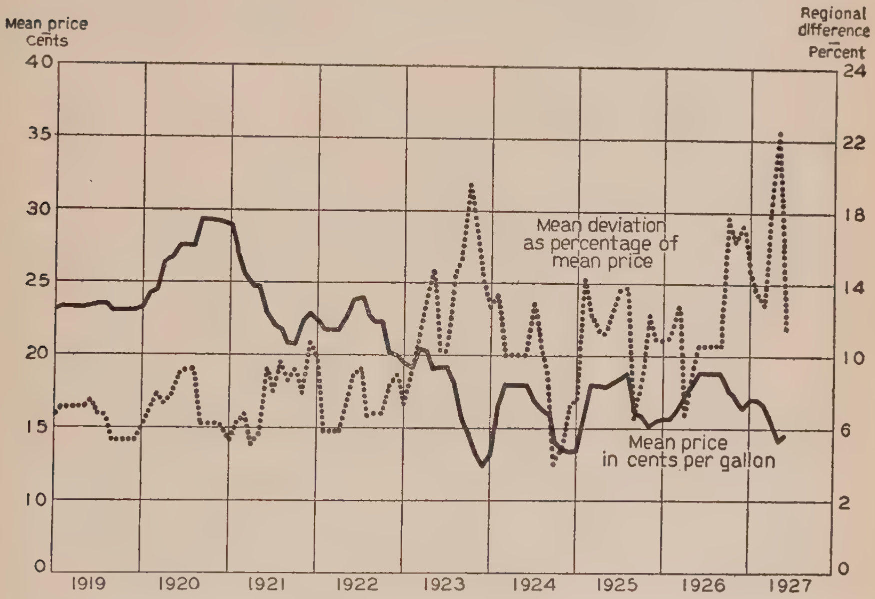
TABLE 59 (Cont.)

(1) Month	(2) Mean price (in cents)	(3) Regional difference (mean deviation)	(4)	(5) Mean price (in cents)	(6) Regional difference (mean deviation)	(7)
		Absolute	Relative		Absolute	Relative
	1925			1926		
January	13.5	1.04	7.7	15.7	1.70	10.9
February	15.9	2.24	14.1	15.7	1.73	11.0
March	18.1	2.22	12.2	16.3	2.09	12.8
April	17.9	2.06	11.5	17.3	1.18	6.8
May	17.8	1.99	11.2	18.1	1.62	8.9
June	18.2	2.30	12.6	18.8	1.99	10.6
July	18.5	2.54	13.7	18.8	1.99	10.6
August	18.8	2.59	13.8	18.8	1.99	10.6
September	16.1	1.04	6.4	18.8	1.99	10.6
October	15.8	1.34	8.5	17.7	3.13	17.7
November	15.2	1.86	12.2	17.2	2.83	16.4
December	15.5	1.70	11.0	16.4	2.84	17.3
	1927					
January	17.0	2.52	14.8			
February	17.0	2.32	13.6			
March	16.6	2.13	12.8			
April	15.4	2.93	19.0			
May	14.1	3.18	22.5			
June	14.7	1.69	11.5			
July	15.0	1.42	9.5			
August	15.1	1.56	10.4			
September	14.6	1.39	9.5			
October	14.2	1.56	11.0			

The average monthly prices and the mean deviations (expressed as percentages of the means) are plotted in Figure 11. The changes here are somewhat more erratic than are those traced in the study of cement price differences. The measure of regional differences in gasoline prices reached its peak and started a precipitous decline five months before the average price had begun to fall. Thereafter, as the average price declined, the measure of regional variation moved upward jerkily, reaching a peak two months before the low of gasoline prices in December, 1923. The mean price fluctuated about a fairly constant level after that date, while the index of regional differences recorded a major decline to a low in October, 1924, and an irregular advance to a new high value in May, 1927. The later entries for 1927 are distinctly lower than the peak value, but well above the average for the years prior to 1923.

FIGURE 11

Average Monthly Prices and Measures of Regional Differences in the Prices of Tank Wagon Gasoline, at Wholesale, in Ten American Cities, 1919-1927.



It is noteworthy that, except for temporary swings, the degree of regional variation in gasoline prices has been distinctly higher for the years 1923 to 1927 than for the years 1919 to 1922. This is more clearly brought out by a comparison of the averages, for these two periods, of the monthly entries in Table 59.

	1919–1922	1923-1927
Mean price of gasoline, at wholesale, in ten cities (in cents)	24.1	16.7
Measure of regional difference (absolute)	1.74	1.96
Measure of regional difference (relative)	7.2	11.8

The samples of wholesale prices presented in this section relate to but a narrow field. Limited though this evidence be, it indicates that there are very considerable regional differences in prices, even in prices relating to thoroughly standardized commodities, and that

TABLE 60

Measures of Regional Differences in Food Prices, at Retail

(1) Commodity	(2) Regional difference (mean deviation as percentage of mean) 39 Cities 1913	(3) 51 Cities 1924
Wheat, cereal		2.8
Oleomargarine		3.4
Butter	2.6	3.8
Sugar, granulated	5.6	4.2
Lard	5.1	4.5
Corn flakes		4.8
Ham, sliced	5.2	5.0
Milk, evaporated		5.3
Nut margarine		5.5
Raisins		5.5
Bread	4.1	5.7
Lamb	6.3	5.9
Cheese	3.2	5.9
Rice	7.9	6.1
Coffee	8.6	6.2
Flour	8.8	6.3
Rolled oats		6.5
Beans, navy		6.5
Tomatoes, canned		6.5
Peas, canned		6.7
Corn, canned		6.7
Vegetable, lard substitute		7.3
Prunes		7.5
Salmon, canned red		7.8
Pork chops	5.0	7.9
Onions		8.2
Bacon, sliced	7.1	8.5
Macaroni		8.7
Beans, baked		8.7
Oranges		9.4
Cabbage		9.8
Tea	9.2	10.4
Chuck roast	5.4	10.5
Hens	7.6	10.6
Plate beef	8.8	11.3
Sirloin steak	7.0	12.2
Milk, fresh	7.4	12.2
Rib roast	6.7	13.5
Potatoes	11.2	13.7
Eggs, strictly fresh	17.5	13.7
Corn meal	19.0	14.7
Round steak	11.4	15.9
Bananas		38.3

these differences vary in magnitude from time to time. A comprehensive collection of measures similar to those given above, based upon quotations for a number of commodities and from a number of cities, would provide material for generalizations concerning regional variations in commodity prices. Although a few quite tentative principles have been suggested in the preceding pages, the data are too limited to justify any general conclusions.

2. Regional Differences in Retail Prices

a. *Foods.* Measures of regional variation in the prices of certain articles of food, at retail, appear in Table 60.[1] For the year 1924 these range in value from 2.8, for wheat cereal, to 38.3, for bananas. The prices of wheat cereal were standardized, and marked by only minor differences from city to city, while there were extreme regional diversities in banana prices. For certain articles prices prevailing in different cities in the year 1913 were available, and these were used in the computation of measures of regional variability for that year. Although the number of cities from which the quotations are drawn was not the same for 1913 as for 1924, some interest attaches to a comparison of the measures for the two years. Detailed comment is unnecessary.

b. *Coal, Gas and Electricity.* Retail prices of certain non-foods are gathered by the United States Bureau of Labor Statistics in a number of cities. Measures of regional differences in the prices of articles used for fuel and lighting, computed as in the preceding examples, appear in the following table.[2]

---

[1] These prices have been secured from the bulletins of the United States Department of Labor on retail prices. For a few commodities the number of cities represented is slightly less than the number indicated in the column headings in Table 60. The measures in column (3) are based upon prices in 49 cities for oleomargarine, 50 cities for sliced ham, 50 cities for cabbages and 45 cities for sirloin steak. The measures in column (2) are based upon prices in 38 cities for sliced ham and 34 cities for plate beef and sirloin steak.

For certain commodities there may be some doubt as to the full comparability of the prices quoted for different cities. The difficulty of securing comparable quotations is greatest for certain of the cuts of beef, but most of the other commodities for which prices are given are standardized. Effort is made by the Bureau of Labor Statistics to secure comparable quotations.

[2] The prices used in preparing Tables 61 and 62 are taken from the *Monthly Labor Review*, a publication of the U. S. Bureau of Labor Statistics.

TABLE 61

MEASURES OF REGIONAL DIFFERENCES IN THE PRICES OF COAL, GAS AND ELECTRICITY, AT RETAIL[1]

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		1913				1924			
Commodity	Unit	No. of cities	Mean price (av. for U. S.)	Regional difference (mean deviation)		No. of cities	Mean price (av. for U. S.)	Regional difference (mean deviation)	
				Absolute	Relative			Absolute	Relative
Anthracite coal	short ton	23	$7.86	$ .77	9.8	28	$16.04	$1.08	6.7
Electricity	100 KW hrs	51	9.34	1.33	14.2	51	8.05	1.12	13.9
Gas (mfd.)	M ft.	43	.95	.11	11.6	42	1.27	.24	18.9
Bituminous coal	short ton	28	6.07	1.70	28.0	38	10.09	2.18	21.6

[1] The prices of bituminous coal and anthracite coal are those prevailing in the various cities on January 15th of the years 1913 and 1924. The 1913 prices of gas are those prevailing on April 15th; the 1924 prices, those on March 15th. The prices of electricity are those prevailing in December of the years named. The prices of electricity, as quoted for different cities, are not perfectly comparable, since the tariffs often differ in other respects than in price. The rates employed in this study are those charged for the first units consumed, not for excess amounts. For convenience in presentation the rates per kilowatt hour have been multiplied by 100, although the initial consumption to which given rates apply is less than 100 kilowatt hours in many cities. Prices are taken from the *Monthly Labor Review.*

With the single exception of the figures relating to electricity, all the measures of regional difference increased in absolute value between 1913 and 1924. The mean deviation of electricity prices in 51 cities declined from $1.33 in 1913 to $1.12 in 1924. This accompanied a decline in the average price of electricity. The relative measures of regional difference declined for the two coal series and for electricity, but in the case of gas there was a material increase. For gas the factors responsible for differences in price, from city to city, were more important in 1924 than they were in 1913. They were less important (i. e. there was a closer approach to a uniform price) for electricity and, on a relative basis, less important for bituminous and anthracite coal.

When these four commodities are ranked on the basis of the 1924 measures of regional difference anthracite coal is found at the top of the list (i. e. its price is more uniform, from city to city, than the prices of the other commodities), with electricity, gas and bituminous coal standing in the order named. The differences in the number of cities from which quotations have been secured should be noted. The relatively small regional differences in the price of Pennsylvania anthracite coal are probably due in part, at least, to the fact that the quotations are drawn from a smaller geographical area than are the quotations for the other commodities.

c. *Dry Goods.* Retail prices of seven dry goods have been utilized in preparing the following table.[1]

TABLE 62

MEASURES OF REGIONAL DIFFERENCES IN RETAIL PRICES OF DRY GOODS

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Commodity	May, 1915			Sept., 1923		
	Mean price per yd.	Regional difference (mean deviation)		Mean price per yd.	Regional difference (mean deviation)	
		Absolute	Relative		Absolute	Relative
Sheeting, bleached	$.312	$.0175	5.6	$ .729	$.0304	4.2
Muslin, bleached	.107	.0067	6.3	.245	.0108	4.4
Sheets, bleached	.822	.0562	6.8	1.803	.0832	4.6
Percale	.130	.0086	6.6	.273	.0141	5.2
Outing flannel, 27-28 inch	.114	.0052	4.6	.252	.0142	5.6
Gingham, apron, 27-28 inch	.081	.0038	4.7	.198	.0113	5.7
Gingham, dress, 27 inch	.120	.0042	3.5	.259	.0156	6.0

Most of the measures of regional price differences for dry goods are lower than those for foods, and all the dry goods measures at the later date are lower than those for fuels. The rise in dry goods prices between 1915 and 1923 has brought, in all cases, an increase in the absolute differences between prices prevailing in different cities. The relative variability has increased for three of the articles quoted and declined for four. According to the 1923 figures, bleached sheeting was more nearly uniform in price than the other articles, while gingham dress goods showed the widest differences.

3. REGIONAL DIFFERENCES IN FARM PRICES[2]

More complete data have been utilized in computing measures of regional variability for seven farm products, for which December 1st farm prices were available by years for the period since 1890. In studying these results two different questions arise. One concerns possible changes in the degree of regional difference in the prices of a specific commodity with the passage of time, the other involves a comparison of commodities in respect to regional price differences. The table immediately below throws some light on the first of these matters. In preparing this table annual measures of regional variability have been averaged, by periods, to facilitate the following of their secular movements. These measures are shown graphically in Figure 12.

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[1] The number of cities represented is 42 in May, 1915, and 51 in September, 1923, except for gingham dress goods, for which quotations for 50 cities were given in 1923.

[2] An important study in this field, dealing, however, with but one commodity, is contained in a report of the United States Department of Agriculture, "Geography of Wheat Prices," by L. B. Zapoleon (*U. S. D. A. Bulletin No.* 594).

TABLE 63

MEASURES OF REGIONAL DIFFERENCES IN FARM PRICES OF SEVEN AGRICULTURAL PRODUCTS

(Based upon December farm prices)

(1) Commodity	(2) Unit	(3) No. of states	(4)	(5)	(6)	(7)	(8)	(9)	(10)
			Mean deviation, in cents						
			1890–1897	1898–1905	1906–1913	1914–1921	1922–1925	1890–1925 inclusive	1890–1925 excluding 1914–1921
Barley	bu.	28	9.0	9.4	9.5	14.1	13.2	10.8	9.8
Corn	bu.	45	10.6	10.7	11.1	17.4	15.2	12.8	11.5
Oats	bu.	45	7.4	7.4	8.2	10.7	11.8	8.8	8.2
Rye	bu.	32	13.1	13.9	15.6	23.6	24.2	17.4	15.6
Wheat	bu.	42	10.5	10.6	10.0	15.7	13.8	11.9	10.8
Potatoes	bu.	46	13.5	15.2	15.4	24.8	28.2	18.4	16.6
Cotton*	lb.	13	.2		.7	1.4	.9	.8	.5

*Cotton prices by states were available only for the years 1890-1899, 1908-1925.

During the 24 years preceding 1914 the measures of regional differences in the prices of five of the above products, expressed in cents per bushel, increased slightly. These were barley, corn, oats, rye and potatoes. A greater increase was recorded in the measure for cotton. The data for the years 1900-1907 are lacking for cotton, however, so that it is impossible to follow the series over the entire period. For wheat alone did the regional differences decline.

The war period brought sharp increases in the absolute measures of regional difference, and these wider spreads between states were in most cases maintained in the last period covered (1922-1925). The annual figures (not given above) show for all seven of the commodities some decline in recent years from the highest values registered between 1917 and 1920, but in all cases except cotton the most recent figures are above the pre-war averages. These annual figures show wheat to be next to cotton in the degree to which pre-war conditions have been approached. This fact of a higher general spread between farm prices in the various states is a matter of considerable interest. It does not seem justifiable to explain it entirely as a result of higher prices, since there was no equal and concurrent rise in these two quantities in the pre-war years. During the period from 1890 to 1913 the relative increase in the prices of the several commodities greatly exceeded the increase in regional spread, except in the case of cotton. Comparing the post-war years (1922-1925) with the last pre-war period (1906-1913), the percentage increase in spread materially exceeded the increase in price for four commodities (barley, oats, rye and potatoes), fell below the price increase for one (cotton) and was approximately equal to the price increase for two (corn and wheat).

FIGURE 12

Absolute Measures of Regional Differences in the Farm Prices of Six Agricultural Products.
Averages, by Periods.
(The measures plotted are the mean deviations of farm prices in cents per bushel in the several states. The number of states represented in each case is given in Table 63.)

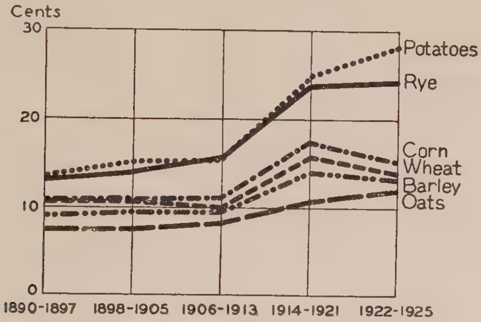


FIGURE 13

Farm Prices of Six Agricultural Products.
Average Price per Bushel, by Periods.

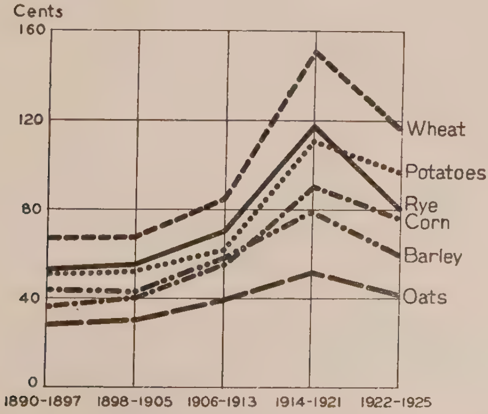
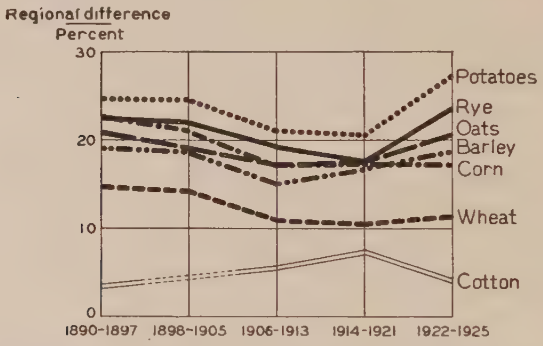


FIGURE 14

Relative Measures of Regional Differences in the Farm Prices of Seven Agricultural Products.

Averages, by Periods.

(Mean deviation as percentage of mean price)



This price rise is shown, for the separate commodities, in Table 64 and in Figure 13. Farm prices, averaged for the periods employed in the preceding table, are here shown. The stability of regional spread prior to 1913 is particularly worthy of note when considered in connection with these figures. Cotton (not shown in Figure 13) stands as the one notable exception which had a greater relative increase in spread than in price during the 24 years preceding the war.

TABLE 64

December Farm Prices of Seven Agricultural Products

(1) Commodity	(2) Unit	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Average December farm prices, in cents						
		1890–1897	1898–1905	1906–1913	1914–1921	1922–1925	1890-1925 inclusive	1890–1925 excluding 1914–1921
Barley	bu.	43.9	42.7	58.4	79.2	59.6	56.4	49.9
Corn	bu.	35.7	40.4	54.8	89.9	76.1	57.5	48.3
Oats	bu.	28.4	30.2	39.3	52.2	41.7	38.0	33.9
Rye	bu.	53.2	54.9	70.3	117.4	79.7	74.6	62.3
Wheat	bu.	67.2	67.6	84.6	150.9	116.2	95.2	79.3
Potatoes	bu.	50.1	52.0	61.6	110.3	96.9	71.6	60.6
Cotton	lb.	7.1	8.3	11.2	19.8	23.9	13.0	11.0

When the measures of regional variability are expressed as percentages of their respective mean values it is possible to compare the different commodities and to follow more accurately the changes in relative variability. These figures appear in the following table. Changes by periods are shown graphically in Figure 14.

TABLE 65

RELATIVE MEASURES OF REGIONAL DIFFERENCES IN FARM PRICES OF SEVEN AGRICULTURAL PRODUCTS

(Based upon December farm prices)

(1) Commodity	(2) No. of states	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Mean deviation as percentage of mean						
		1890–1897	1898–1905	1906–1913	1914–1921	1922–1925	1890–1925 inclusive	1890–1925 excluding 1914–1921
Barley	28	19.2	18.7	15.2	16.7	18.7	17.6	17.8
Corn	45	22.8	20.9	17.1	17.3	17.2	19.3	19.8
Oats	45	20.8	19.0	17.1	17.4	20.7	18.8	19.2
Rye	32	22.5	21.8	19.2	17.5	23.4	20.6	21.5
Wheat	42	14.7	14.1	10.9	10.5	11.2	12.4	12.9
Potatoes	46	24.7	24.6	21.1	20.6	27.2	23.2	24.0
Cotton	13	3.4		*5.5	7.3	4.0	* 4.9	* 4.0

*Cotton figures were available from 1890 to 1899 and from 1908 to 1925. The average for 1906-1913 is based on 6 years, and the averages for 1890-1925, including and excluding 1914-1921, are based on the 28 and 20 years, respectively, for which figures were available.

Of the seven articles listed cotton shows by far the smallest relative regional variation while potatoes, with a measure approximately six times that of cotton, has the highest. Some of the reasons for this are clear. The cotton states constitute a fairly homogeneous territory, and the price of cotton is set in a national, if not in a world market. Differences in price attributable to transportation charges are relatively low. In all these respects potatoes stand at the other extreme from cotton, and the wide difference in regional variability is a natural consequence.

The grains fall between cotton and potatoes in the matter of regional variability, with wheat at one extreme (the lowest) and rye at the other, not far below potatoes.

The pre-war trends of the percentage measures of regional difference were downward (except for cotton), a fact which follows naturally from the upward course of prices and the approximate stability of the inter-state spread, expressed in cents. During the last period covered (1922-1925) lower prices brought increases in the relative spread. Potatoes and rye were carried above the highest pre-war figure, oats and barley approximately up to the highest pre-war average, while wheat, corn and cotton remained relatively low.

§ Regional Differences in Discount Rates

The records of regional differences in commodity prices may be supplemented, for purposes of comparison, by some figures relating to corresponding differences in discount rates. In view of the mobility of capital and the wide extent of the market for capital and credit it might be expected that the regional differences in discount rates would be relatively small. This assumption may be tested by means of the data on discount rates in a number of important cities which are compiled by the Federal Reserve Board and published monthly in the *Federal Reserve Bulletin.* They relate to customers' prime commercial loans. The original rates, as quoted for individual cities, are not averages, but are the rates at which the bulk of the loans of this class are made by reporting banks. Where the reported rates are given in terms of the range from low to high, an average of these limits has been taken. The Federal Reserve Board's reports show that some changes have been made from time to time in the method of reporting rates, but it does not appear that these have seriously affected the comparability of the rates for different periods. The comparison of cities, however, in respect to discount rates must be made with some reservations, because of the difficulty of securing fully comparable returns. Significance should not be attached, therefore, to minor differences between the averages for different cities. The larger differences represent true regional variations of considerable economic importance.

In the following table are given the average discount rates, by months from July, 1918, to August, 1927, and measures of regional differences in discount rates. The basic measure of regional difference is the *mean deviation,* deviations being measured from the arithmetic average of the rates prevailing in the several cities at each date. In the table this is shown in absolute form and as a percentage of the average rate.

TABLE 66

AVERAGE DISCOUNT RATES ON CUSTOMERS' LOANS IN AMERICAN CITIES, WITH MEASURES OF REGIONAL DIFFERENCES, 1918-1927

(The number of cities represented has varied from 32 to 35 since 1920. In 1918 and 1919 the number ranged from 26 to 32. For the names of cities and the original quotations see the *Federal Reserve Bulletin.*)

(1) Date		(2) Average rate	(3) Regional difference (mean deviation) Absolute	(4) Relative
1918				
	July	6.05	.39	6.5
	Aug.	6.20	.45	7.2
	Sept.	6.23	.52	8.3
	Oct.	6.20	.47	7.5
	Nov.	6.23	.47	7.5
	Dec.	6.14	.50	8.1

TABLE 66 (Cont.)

(1) Date		(2) Average rate	Regional difference (mean deviation)	
			(3) Absolute	(4) Relative
1919				
	Jan.	6.14	.54	8.8
	Feb.	6.14	.54	8.8
	March	6.06	.54	8.9
	April	6.04	.56	9.3
	May	6.10	.56	9.2
	June	6.01	.54	8.9
	July	6.02	.54	8.9
	Aug.	6.05	.50	8.3
	Sept.	6.06	.52	8.6
	Oct.	6.02	.49	8.1
	Nov.	6.08	.49	8.0
	Dec.	6.06	.46	7.6
1920				
	Jan.	6.14	.49	8.0
	Feb.	6.36	.43	6.8
	March	6.45	.39	6.0
	April	6.55	.39	5.9
	May	6.69	.43	6.4
	June	6.81	.41	6.0
	July	6.86	.37	5.4
	Aug.	6.89	.37	5.4
	Sept.	6.89	.42	6.1
	Oct.	6.88	.44	6.4
	Nov.	6.91	.39	5.6
	Dec.	6.94	.40	5.8
1921				
	Jan.	6.97	.42	6.0
	Feb.	6.99	.45	6.4
	March	6.96	.40	5.8
	April	7.02	.43	6.2
	May	6.96	.40	5.8
	June	6.94	.39	5.6
	July	6.97	.39	5.6
	Aug.	6.89	.41	6.0
	Sept.	6.87	.42	6.1
	Oct.	6.86	.42	6.2
	Nov.	6.84	.43	6.3
	Dec.	6.71	.51	7.6
1922				
	Jan.	6.64	.54	8.2
	Feb.	6.54	.61	9.4
	March	6.43	.54	8.4
	April	6.38	.59	9.2
	May	6.27	.63	10.1
	June	6.25	.62	9.9
	July	6.12	.61	10.0
	Aug.	6.08	.66	10.8
	Sept.	6.10	.72	11.8
	Oct.	6.01	.58	9.6
	Nov.	5.97	.59	9.9
	Dec.	6.11	.64	10.5
1923				
	Jan.	6.05	.60	9.9
	Feb.	5.99	.64	10.6
	March	6.06	.55	9.0
	April	6.04	.56	9.3
	May	6.13	.55	9.0
	June	6.10	.54	8.9
	July	6.10	.59	9.6
	Aug.	6.12	.58	9.5
	Sept	6.20	.59	9.5
	Oct.	6.16	.63	10.2
	Nov.	6.15	.54	8.9
	Dec.	6.12	.56	9.1
1924				
	Jan.	6.21	.56	9.0
	Feb.	5.97	.46	7.8
	March	5.96	.46	7.7
	April	5.93	.48	8.2
	May	5.89	.49	8.4

TABLE 66 (Conc.)

(1) Date	(2) Average rate	(3) Regional difference (mean deviation)	(4)
		Absolute	Relative
1924 (cont.)			
June	5.72	.52	9.0
July	5.68	.59	10.4
Aug.	5.54	.58	10.5
Sept.	5.61	.66	11.8
Oct.	5.52	.60	10.9
Nov.	5.53	.58	10.5
Dec.	5.53	.57	10.3
1925			
Jan.	5.50	.56	10.2
Feb.	5.53	.57	10.4
March	5.54	.50	9.1
April	5.57	.54	9.7
May	5.58	.57	10.3
June	5.57	.53	9.5
July	5.57	.57	10.2
Aug.	5.53	.55	10.0
Sept.	5.55	.51	9.2
Oct.	5.61	.54	9.7
Nov.	5.67	.54	9.5
Dec.	5.64	.52	9.2
1926			
Jan.	5.62	.49	8.8
Feb.	5.65	.51	9.0
March	5.61	.48	8.5
April	5.63	.47	8.4
May	5.62	.48	8.6
June	5.55	.53	9.5
July	5.54	.51	9.3
Aug.	5.57	.52	9.4
Sept.	5.62	.49	8.8
Oct.	5.66	.46	8.2
Nov.	5.62	.45	8.0
Dec.	5.65	.50	8.8
1927			
Jan.	5.61	.47	8.4
Feb.	5.64	.48	8.6
March	5.60	.52	9.3
April	5.60	.53	9.5
May	5.59	.52	9.4
June	5.57	.52	9.3
July	5.54	.47	8.6
Aug.	5.53	.53	9.6

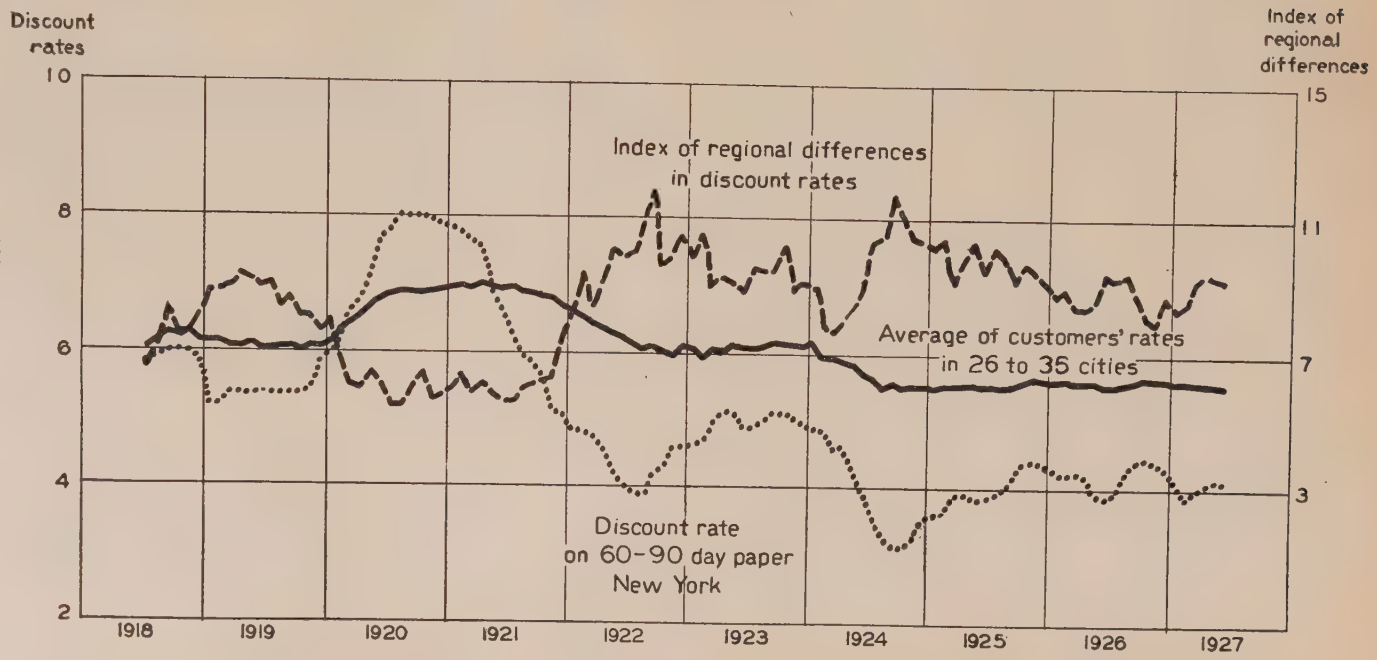
The mean rates and the relative measures of regional difference are plotted in Figure 15. It is clear from this graph that the degree of regional difference in discount rates varies considerably from time to time. The regional discrepancies were at a minimum during the period of high average rates in 1920 and 1921, and reached maximum values following the general decline of rates in 1921-22 and in 1924. The general course of the index of regional differences shows three relatively short periods of increase and three much longer periods of decline. The first increase came in late 1918 and early 1919, the second in 1921-22, the third in 1924. Each was followed by a considerably longer period of decline.

The general relationship between movements of the average rate and changes in degree of regional difference is an inverse one. With every sustained rise in the average rate there has been a decline in the degree of regional difference, and with every sustained fall in the average rate there has been an increase in these differences. High rates bring an approach to uniformity. With a low average rate there is a wide range between the charges in individual cities. This may be due to the fact

FIGURE 15

AVERAGE DISCOUNT RATE ON CUSTOMERS' LOANS IN 26 TO 35 CITIES, INDEX OF REGIONAL DIFFERENCES IN CUSTOMERS' RATES, AND RATE ON 60-90 DAY PAPER IN NEW YORK.

July, 1918—June, 1927.



that in some cities the fairly high rate which is set by custom or by regulation tends to prevail at all seasons. A decline in the average rate brings wider regional differences because the downward movement is generally much more marked in some cities than in others.

An alternative or parallel explanation of the changes in the index of regional differences in discount rates is offered by Mr. George Soule. Mr. Soule suggests that discount rates may be more uniform throughout the country when the member banks have to depend more largely on the reserve banks for their sources of credit. Conversely, departures from uniformity would be most pronounced when member banks are least dependent on the reserve banks in this respect. A month-by-month comparison of the index of regional differences in discount rates and discounts for member banks by the federal reserve banks between 1918 and 1927 shows an inverse relationship, which accords with Mr. Soule's explanation.

Some interest attaches to a comparison of the average of these rates with the market rate on 60-90 day paper in New York. (This latter figure, it should be noted, is the market rate as quoted in financial papers. It is not the "customers' rate", upon which the general averages are based.) This series is plotted on the same chart. As might be expected, the average rate for the country at large fluctuates over a much narrower range than does the New York rate, and moves in general on a distinctly higher level. Only during the period of violent disturbance between February, 1920, and May, 1921, was the average rate below the market rate in New York.

A somewhat more realistic view of the degree of regional difference in discount rates is afforded by the following table, showing the average rate in each of 34 cities during the five year period 1922-1926.

TABLE 67

DISCOUNT RATES ON CUSTOMERS' LOANS

AVERAGE RATES IN THIRTY FOUR AMERICAN CITIES, 1922-1926.

(1) Rank	(2) City	(3) Average rate	(1) Rank	(2) City	(3) Average rate
1	Boston	4.77	18	Cleveland	5.79
2	Philadelphia	4.95	19	Louisville	5.81
3	St. Louis	4.96	20	New Orleans	5.82
4	New York	5.01	21	Houston	5.82
5	Chicago	5.02	22	Denver	6.12
6	Minneapolis	5.18	23	Birmingham	6.14
7	Baltimore	5.36	24	Little Rock	6.21
8	San Francisco	5.40	25	Portland, Ore.	6.26
9	Richmond	5.41	26	Seattle	6.27
10	Dallas	5.44	27	Jacksonville	6.29
11	Detroit	5.49	28	Los Angeles	6.29
12	Pittsburgh	5.65	29	Salt Lake City	6.33
13	Kansas City	5.70	30	Nashville	6.35
14	Omaha	5.71	31	Spokane	6.40
15	Atlanta	5.71	32	Oklahoma City	6.67
16	Cincinnati	5.72	33	El Paso	7.63
17	Buffalo	5.76	34	Helena	7.73

The large cities of the northeast have the lowest rates, in general, while the higher rates are found in cities of the west and south. Although there is no sharp geographical division, the following grouping reveals certain broad differences between regions:

Group	Average rate on customers' loans, 1922–1926
Cities of the Middle Atlantic and Northeast (Boston, Philadelphia, New York, Buffalo)	5.12
Cities of the Upper Mississippi (St. Louis, Chicago, Minneapolis, Detroit, Pittsburgh, Cincinnati, Cleveland)	5.40
Cities of the South (Baltimore, Richmond, Atlanta, New Orleans, Louisville, Birmingham, Jacksonville, Nashville)	5.86
Cities of the Pacific Coast (San Francisco, Portland, Seattle, Los Angeles, Spokane)	6.12
Cities of the Western Plains and Rocky Mountains (Kansas City, Omaha, Denver, Salt Lake City, Helena)	6.32
Cities of the Southwest (Dallas, Houston, Little Rock, Oklahoma City, El Paso)	6.35

The differences between cities and between the various groups of cities distinguished above represent variations in the degree of commercial development and business stability, differences in the amount of available credit and differences in the intensity of the demand for capital and credit, as well as variations in local business conditions and banking habits.

It is impossible, with the data available, to make an accurate comparison of discount rates and the prices of specific commodities in respect to regional variation. The markets from which the original quotations were drawn were not the same, nor were the periods of time covered identical. A rough comparison is of some interest, but the conclusions to be drawn are merely suggestive, and not final.

Certain measures of regional variation, all in relative form, are brought together in the table on the next page.

Discount rates appear to be more uniform in price than most of the farm price and wholesale price series. There is one exception in the former group, for the farm price of cotton is marked by much smaller regional differences than are discount rates. Among commodities at wholesale the averages for Portland cement and gasoline are only slightly greater than that for discount rates. All the dry goods are more uniform, in their retail price quotations, than discount rates.

In addition to the articles listed above measures for 43 articles of food, at retail, are given in Table 60. These are based upon quotations from 51 cities. The measure of regional differences in discount rates exceeds the corresponding measures for 26 of these articles, and is exceeded by the measures for 17 foods.

TABLE 68

MEASURES OF REGIONAL DIFFERENCES IN DISCOUNT RATES AND IN SELECTED COMMODITY PRICE SERIES.

(1) Series	(2) Period covered by original quotations	(3) No. of markets represented	(4) Average measure of regional difference (relative)
Discount rates	1918–1927	26 to 35	8.5
Farm prices			
Cotton	1922–1925	13	4.0
Wheat	1922–1925	42	11.2
Corn	1922–1925	45	17.2
Barley	1922–1925	28	18.7
Oats	1922–1925	45	20.7
Rye	1922–1925	32	23.4
Potatoes	1922–1925	46	27.2
Building materials			
Portland cement	1922–1925	24	9.9
Wire nails	1922–1925	16	13.8
Lime	1922–1925	22	13.8
Brick	1922–1925	24	14.0
Pine boards	1922–1925	16	18.1
Sand	1922–1925	21	21.1
Gasoline	1920–1927	50	8.8
Dry goods at retail			
Sheeting, bleached	1923	51	4.2
Muslin, bleached	1923	51	4.4
Percale	1923	51	5.2
Flannel, outing	1923	51	5.6
Gingham, apron	1923	51	5.7
Fuels, at retail			
Anthracite coal	1924	28	6.7
Electricity	1924	51	13.9
Gas, manufactured	1924	42	18.9
Bituminous coal	1924	38	21.6

The degree of regional diversity in discount rates is somewhat greater than might have been expected. In spite of the traditionally wide market for credit, regional differences in discount rates appear to be greater than those found among many commodities in retail markets, and are not materially lower than the differences prevailing in the prices of certain staple commodities in wholesale markets.

II Regional Differences in Price Behavior

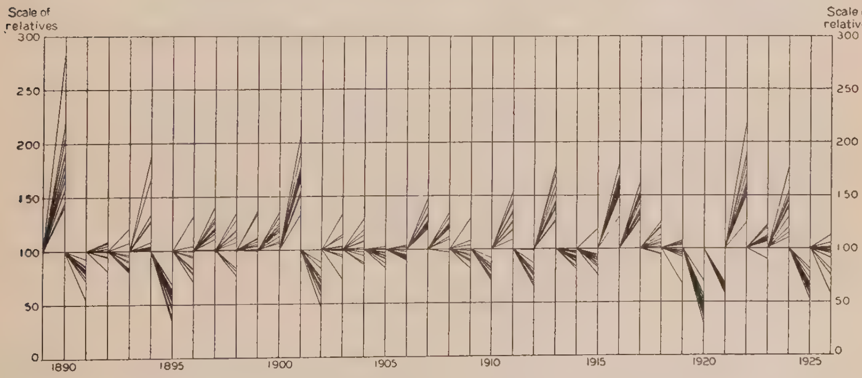
An example of obvious regional differences in price behavior is afforded by index numbers of wholesale prices in different countries. That American and German prices followed somewhat different courses between 1915 and 1925 needs no demonstration. Our present concern, however, is not with international differences in the movements of wholesale price index numbers. The objects of immediate interest are the less obvious differences between the behavior of the prices of individual commodities and commodity groups in different markets and in different geographical areas. The aspects of price behavior which should be studied in making this regional comparison include all those which have been discussed in the preceding chapter. Only a few illustrative examples may be given in each case.

1. Regional Differences in Degree of Price Change between Given Dates

Material differences in the degree of change in the prices of a given commodity from year to year, in different markets, are revealed by the data plotted in Figure 16. Here are shown link relatives computed from December 1st farm prices of corn in ten states, during the period 1889-1926. The scatter of the relatives for the separate states, from year to year, indicates the diversities in the movements of corn prices. (Since, for the purpose in hand, interest attaches only to the differences between the degree of change in different states, no attempt is made in this chart to distinguish the relatives for individual states.) To accept as representative of changes in the farm price of corn the figures relating to any one state, or even the average for the entire country, is to ignore the striking differences which are shown by the separate state figures.

FIGURE 16

Link Relatives of the Average Farm Prices of Corn in Ten Important Producing States, 1889-1926.

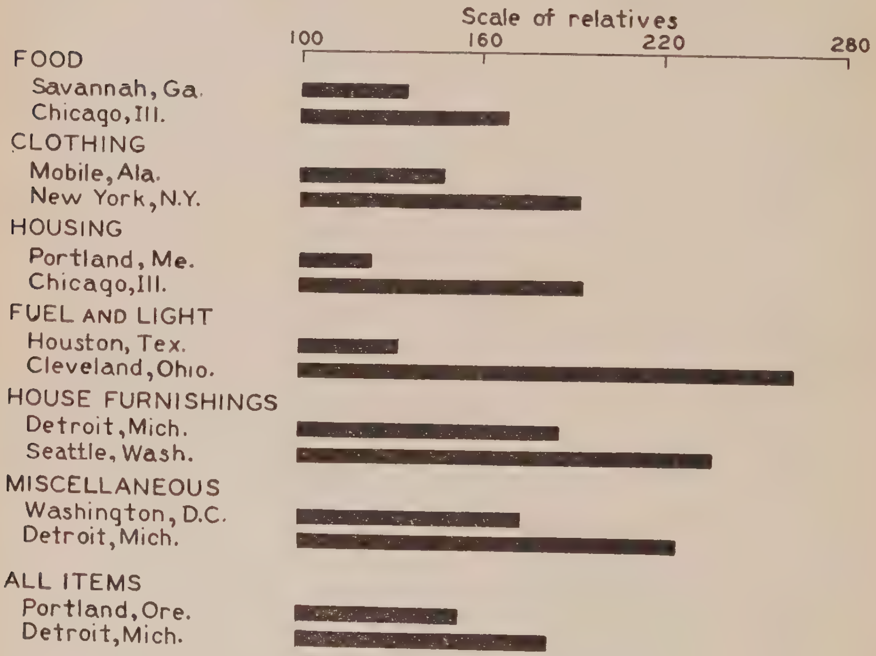


More striking evidence of the differences which may develop between different parts of the country in the matter of price changes is found in the cost of living figures compiled by the Bureau of Labor Statistics. Index numbers showing changes in the cost of living and changes in the cost of items falling in certain sub-groups have been constructed for 19 cities. The following diagram shows the city in which the smallest change was recorded for each of these groups and for the general index between December, 1914, and June, 1927, and the city in which the greatest change took place. The data upon which the chart is based appear in Table 69.

FIGURE 17

Diagram Showing Regional Differences in the Degree of Change in Cost of Living in the United States between 1914 and 1927.

The bars indicate the minimum and maximum changes in the cost of living, and in the cost of certain important groups of items in the cost of living, between December, 1914, and June, 1927, as recorded for 19 American Cities. (Costs in December, 1914=100)



The differences between cities are doubtless somewhat greater than would be found if corresponding wholesale price index numbers were available. They indicate, however, that any study of the price structure must take account of regional variations in price behavior. This is particularly true of a country having the diversity of economic and social conditions found in the United States.

TABLE 69

REGIONAL DIFFERENCES IN THE DEGREE OF CHANGE IN COST OF LIVING IN THE UNITED STATES BETWEEN 1914 AND 1927.

Price group	City in which smallest change was recorded	Index June 1927 (Dec. 1914 =100)	City in which greatest change was recorded	Index June 1927 (Dec. 1914 =100)
Food	Savannah, Ga.	135.4	Chicago, Ill.	168.2
Clothing	Mobile, Ala.	147.6	New York, N. Y.	192.9
Housing	Portland, Me.	123.6	Chicago, Ill.	193.9
Fuel and light	Houston, Tex.	132.8	Cleveland, O.	263.9
House furnishing goods	Detroit, Mich.	186.8	Seattle, Wash.	236.8
Miscellaneous	Washington, D. C.	173.6	Detroit, Mich.	225.1
All items	Portland, Ore.	153.7	Detroit, Mich.	182.7

2. REGIONAL DIFFERENCES IN THE VARIABILITY OF PRICES

a. *Year-to-Year Variability.* In a preceding section measures of price variability for a number of commodities were presented. In considering such a figure for a given commodity one tends to think of this variability as an attribute of the commodity. But it is also an attribute of the market, or of the region, from which the quotations are drawn. Price habits and other price determining factors may differ from place to place. Quite different measures might be secured, for the same commodity, by employing prices drawn from different markets. The figures in column (2) of the following table indicate the degree of difference in year-to-year variability found in the farm prices of corn, in 10 states.

TABLE 70

REGIONAL DIFFERENCES IN YEAR-TO-YEAR VARIABILITY OF FARM PRICES OF CORN, 1889-1913[1]

(The measures of variability are based upon December 1st farm prices.)

(1) State	(2) Measure of year-to-year variability (mean deviation as percentage of mean)	(3) Percentage of total U. S. corn crop, 1906
Tennessee	15.1	2.9
Minnesota	19.4	1.7
Ohio	19.6	4.8
Kentucky	20.2	3.6
Illinois	20.7	11.8
Indiana	21.3	6.3
Texas	22.2	5.3
Missouri	24.6	7.8
Iowa	29.6	12.7
Nebraska	33.6	8.5
United States	20.8	100.0

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[1] A similar set of measures relating to oats appears in the footnote on pp. 54-55.

The measure given above for the United States is slightly greater than that given on an earlier page. The earlier figure was based upon data for the period 1890-1913.

The measures of variability run from 15.1 for Tennessee to 33.6 for Nebraska, a very considerable range of variation. There is some positive correlation between the year-to-year variability of corn prices in given states and the percentage of the total corn crop produced in those states, as listed in column (3). (The percentages are based upon the crop in 1906, a year near the middle of the period covered by the measures of price variability.) The correlation coefficient has a value of +.75. A similar coefficient for oats has a value of +.76. Each of these coefficients is based, it should be noted, on only 10 observations.

We may next inquire whether there are differences in price behavior, similar to the above, in wholesale markets in different countries. The figures in Table 71 relate to the behavior of a number of commodities, in four countries. Certain of these are compared graphically in the accompanying diagram.

FIGURE 18

International Differences in the Variability of Wholesale Prices, 1890-1913.

Comparison of Four Commodities in Four Countries in respect to Year-to-Year Variability.

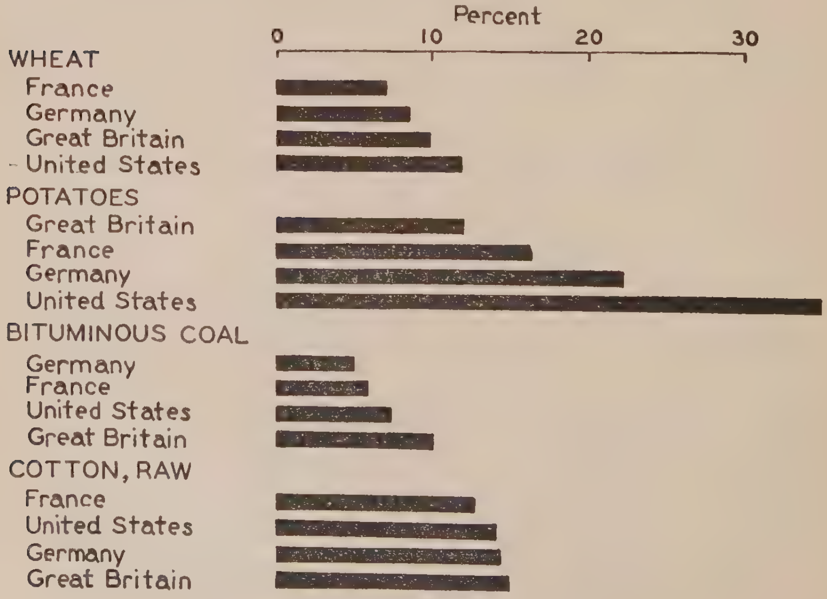


TABLE 71

COMPARISON OF MEASURES OF YEAR-TO-YEAR VARIABILITY OF THE PRICES OF SIXTEEN COMMODITIES IN FOUR COUNTRIES, 1890-1913[1]

(Calendar year measures)

(1) Commodity	(2)	(3) Measures of year-to-year variability	(4)	(5)
	United States	Great Britain	Germany	France
Wheat	11.7	9.7	8.4	7.0
Rye	14.4		9.2	
Potatoes	34.5	12.0	22.1	16.3
Sugar, raw	9.4	8.5	12.2	
Sugar, refined	7.9		7.7	10.8
Cotton, raw	14.2	14.9	14.4	12.8
Cotton yarn	9.9	12.3	12.8	
Pig iron	15.5	9.3	9.0	
Copper	13.3	9.5	11.9	
Coal, bituminous	7.4	10.0	5.0	5.8
Petroleum	19.4	9.1		14.2
Wool	8.8	5.6		
Silk	10.4	4.7		
Rubber	15.9	10.6		
Hides	12.9	4.1		
Coffee	17.3	9.2		8.8

[1] The sources of the quotations used in computing the above measures, and the character of the quotations, are described below:

United States:

Average annual prices as compiled and published by the Bureau of Labor Statistics. For detailed descriptions see Table I, in the Appendix. For commodities represented by duplicate quotations, the following series were used:

Cotton yarns, carded, cones, 10/1
Pig iron, basic
Coal, bituminous, Pocahontas
Wool, fine clothing
Silk, raw, Kansai No. 1

Great Britain:

Wheat, good average quality red wheat, Liverpool (From *Yearbook*, U. S. Dept. of Agriculture. Compiled from *Broomhall's Yearbook* and *Corn Trade News*.)
Cotton, middling upland. Annual average prices computed from closing prices on first or near the first of each month, as quoted in *Commercial and Financial Chronicle*.
Cotton yarns, 32's, cop twist. Annual average prices computed from average low price for first week in each month, as quoted in *Commercial and Financial Chronicle*.
The remaining British measures were computed from price relatives as given, without detailed description, in the *Abstract of Labor Statistics*, Great Britain. Wool prices relate to imported wool, while the copper quoted 'includes ore and regulars.'

Germany:

The German prices, with the exception of those for coal, are taken from *Monatshefte zur Statistik des Deutschen Reichs*. The quotations on coal are from *Vierteljahrshefte zur Statistik des Deutschen Reichs*.

France:

The French prices, with the exception of those for wheat and coal, relate to import values, as determined by customs officials. Quotations are from *Annuaire Statistique de la France*. Wheat prices are from the *Statistique Agricole Annuelle*, and coal prices are from the *Statistique de l'Industrie Minérale*.

In comparing the figures in Table 71 we cannot be sure that we are dealing with precisely identical commodities, nor that the quotations are fully comparable in all respects. There is no reason for doubting, however, that the differences in variability revealed by this table represent, primarily, regional differences in price behavior.

A more refined comparison would doubtless give somewhat different results, in detail, but the general picture would be much the same.

Judging from the group of commodities here listed, American prices seem to be more variable, on the whole, than prices abroad. Direct comparison between the United States and Great Britain is possible in 14 cases. For only 3 commodities (raw cotton, cotton yarn and coal) are the American prices less variable, from year to year, than the British. Comparison of American with German figures is possible in 10 cases. In only 3 of these cases (with respect to raw sugar, raw cotton and cotton yarn) are the American prices less variable. Seven American and French price series may be compared. For only one commodity (refined sugar) are the American prices less variable.

An attempt to explain these differences would carry us beyond the limits of the present discussion. It may be that the rapid rate of industrial development in the United States has had, as an accompaniment, more variable prices than are found under more stable economic conditions. Comprehensive international comparisons of this sort might be expected to yield valuable information concerning international differences in economic processes.

b. *Monthly Variability.* Measures of monthly price variability may be utilized in a similar comparison of markets in different geographical areas. Data for an adequate survey of this type are not at present available. A single example relating to domestic differences and several relating to international differences will serve to illustrate the procedure.

Quotations relating to tank wagon prices of gasoline on a date near the first of each month in 14 different cities, during the years 1919 to 1925, inclusive, were compiled[1], and measures of monthly variability similar to those presented in an earlier section were computed for these years. The mean price and the average value of the measures of monthly variability for each city during this period are given in Table 72.

The mean price varies from 18.5 cents per gallon, in Los Angeles, to 23.5 cents, in Boston, while the measure of monthly variability ranges from 6.9 per cent in Birmingham, to 11.1 per cent in Omaha. There appears to be a slight inverse relation between the mean price and the measure of variability, the variability tending to be less with a high price than with a low. The relation-

[1] The prices were taken from the *National Petroleum News.* They are wholesale tank wagon prices, excluding local taxes.

TABLE 72

REGIONAL DIFFERENCES IN MONTHLY VARIABILITY OF TANK WAGON GASOLINE PRICES, AT WHOLESALE

1919-1925

(1) City	(2) Mean monthly price (in cents)	(3) Mean deviation as percentage of mean Average of annual values
Birmingham	21.5	6.9
New York	23.2	7.1
Seattle	19.8	7.1
San Francisco	18.9	7.2
Pittsburgh	22.4	7.4
Boston	23.5	7.6
Los Angeles	18.5	8.4
Atlanta	21.8	8.9
Oklahoma City	19.0	9.2
Detroit	21.0	9.3
Denver	21.3	9.5
El Paso	19.9	9.6
Kansas City	18.9	10.5
Omaha	20.1	11.1

ship is not pronounced, however, and the sample is too small to permit of generalization. For our present purpose the point of importance in the above table is the evidence it affords that the degree of variability of the price of a given commodity depends not only on the characteristics of that commodity, but upon the characteristics of the particular market from which the quotations are taken.

The following table permits a comparison of markets separated by national boundaries. As in all international comparisons, there must be some doubt as to whether the series are comparable in all respects. Nevertheless, the chief reason for the differences in variability noted is probably to be found in the geographical separation of the markets from which the quotations are drawn, and it is the effect of this separation which is of present interest.

TABLE 73

COMPARISON OF MEASURES OF MONTHLY VARIABILITY OF THE PRICES OF FOUR COMMODITIES IN AMERICAN AND BRITISH MARKETS

(Calendar year measures)

(1) Commodity	(2) Measures of monthly variability 1890-1925 (excluding 1914-1921) United States	(3) Great Britain
Cotton, raw	8.1	8.0
Cotton yarn	5.4	5.5
Pig iron	6.5	4.3
Wheat	6.8[1]	4.9

[1] This is reduced to 5.5 if crop year figures be used.

The measures show only slight differences between the wholesale prices of raw cotton and cotton yarn in the United States and Great Britain in respect to monthly variability, but pig iron and wheat appear to be appreciably more variable in the United States in their monthly price movements. This result agrees with that secured in the comparison of year-to-year measures.

§ Regional Differences in the Monthly Variability of Discount Rates

In an earlier section measures of regional differences in discount rates in the United States were discussed, and compared with similar measures for commodity prices. Equal interest attaches to regional differences in the variability of discount rates.

Using the data previously employed, measures of monthly variability have been computed. As with commodity prices, variation within each calendar year has been measured by the *mean deviation* of the monthly values, expressed as a percentage of the annual average. These measures, averaged for each of 34 cities for the years 1922-1926, are shown below.

TABLE 74

Measures of Variability of Discount Rates on Customers' Loans in Thirty Four American Cities, 1922-1926.

(1) Rank	(2) City	(3) Measure of variability	(1) Rank	(2) City	(3) Measure of variability
1	Nashville	.99	18	Salt Lake City	2.99
2	Helena	1.16	19	Chicago	3.28
3	Louisville	1.79	20	Los Angeles	3.36
4	Buffalo	1.87	21	Richmond	3.51
5	Houston	1.97	22	Kansas City	3.61
6	Little Rock	2.31	23	El Paso	3.83
7	Seattle	2.33	24	Birmingham	3.88
8	Cincinnati	2.34	25	Omaha	3.92
9	Portland, Ore.	2.38	26	Oklahoma City	3.97
10	Baltimore	2.42	27	Philadelphia	4.30
11	Detroit	2.46	28	Boston	4.31
12	Atlanta	2.52	29	New York	4.41
13	Spokane	2.60	30	Minneapolis	4.54
14	New Orleans	2.64	31	Dallas	4.54
15	Cleveland	2.65	32	Denver	4.56
16	San Francisco	2.93	33	St. Louis	4.93
17	Pittsburgh	2.99	34	Jacksonville	6.11

These figures are presented graphically in Figure 19.

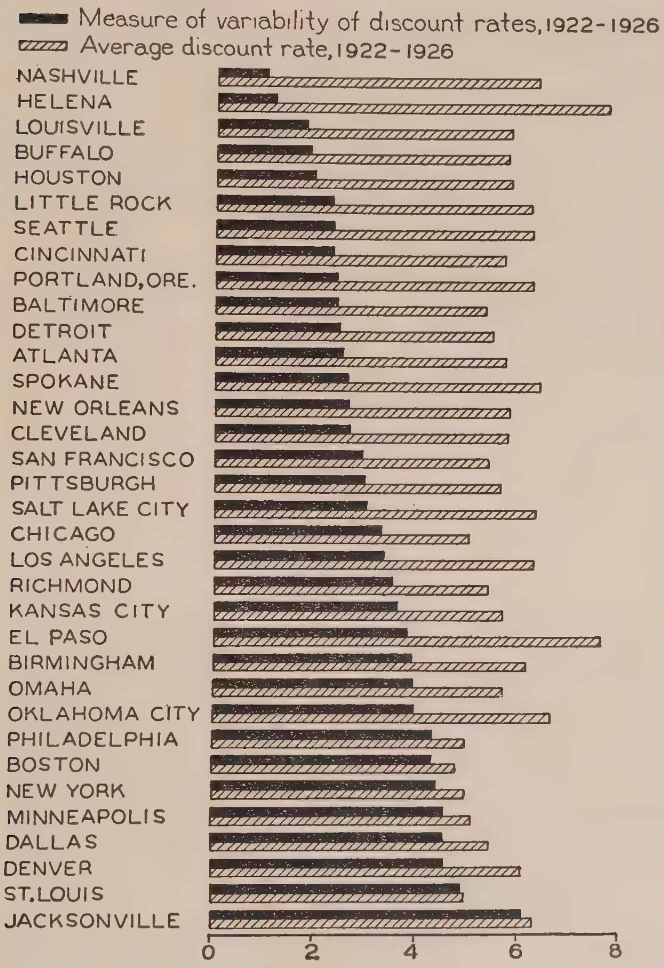
Differences between cities in respect to the stability of discount rates are much greater than are the differences in the average rates. The range from the lowest to the highest value extends from .99 to 6.11, as compared with a range from 4.77 to 7.73 in average rates. Although the big eastern cities, Philadelphia, Boston and New York, stand near the lower end of the scale with relatively variable rates, there is no clear division in the matter of variability between the smaller centers and the

FIGURE 19

DISCOUNT RATES IN AMERICAN CITIES.

Customers' Rates and Measures of Variability of Customers' Rates in 34 Cities. Averages of Monthly Measures During the Period 1922-1926.

(Cities ranked in order of magnitude of the measures of variability.)



larger, nor between the east, on the one hand, and the south and west on the other. In some centers a standard rate prevails with little change from month to month or from year to year, while in others rates are flexible and variable. In so far as may be judged from the present figures local conditions and customs, rather than broad geographical or economic factors, account for these regional differences in the variability of discount rates.

c. *Frequency of Price Change.* In the general discussion of price variability in an earlier section a measure of the frequency of price change was employed. This is the ratio of the number of changes in price to the number of monthly quotations.[1] In determining whether there are significant differences in respect to frequency of change in the prices of an identical commodity in different markets, data relating to tank wagon gasoline prices may be employed. The results appear in the following table.

TABLE 75

Regional Differences in Frequency of Month-to-Month Change in Tank Wagon Gasoline Prices, at Wholesale, 1919-1925

City	Measure of frequency of price change
Los Angeles	.23
San Francisco	.23
Seattle	.23
Detroit	.40
Omaha	.40
Kansas City	.42
New York	.44
Boston	.46
Pittsburgh	.46
Birmingham	.46
El Paso	.47
Atlanta	.48
Denver	.52
Oklahoma City	.53

Since these figures relate only to a seven year period, and that a period marked by extreme price changes, they are not comparable to the measures of frequency of change presented in an earlier section for a long list of commodities. The measures for the different cities listed above are fully comparable, however.

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[1] More accurately, it is the ratio of the number of price changes to the number of monthly quotations minus 1. This gives a measure which will have a value of unity if there is a price change every month, and a value of zero if the price is constant during the entire period covered.

There is considerable variation in the frequency of price change, the ratio varying from .23 for Los Angeles, San Francisco and Seattle, to .53 for Oklahoma City. The tank wagon price of gasoline changed about 1 month in 4 in the three Pacific Coast cities, and about 1 month in 2 in Oklahoma City.

The ranking, it may be noted, differs considerably from that based upon monthly variability (Table 72). That is, the cities in which the monthly price variation is most extreme are not necessarily those in which the frequency of change is highest.

International comparison of commodities in the matter of frequency of monthly price change reveals similar differences. The difficulty, previously mentioned, of securing quotations that are fully comparable is encountered in making such comparisons. The results given below must be interpreted with this difficulty in mind.

TABLE 76

Comparison of Measures of Frequency of Month-to-Month Change in the Wholesale Prices of Three Commodities in American and British Markets

(1) Commodity[1]	(2) Measures of frequency of price change 1890-1925 (excluding 1914-1921) United States	(3) Great Britain
Pig iron	.77	.94
Cotton, spot	.99	.95
Cotton yarn	.74	.91

[1] The descriptions of these commodities follow:

Pig iron:	United States: foundry no. 1 to 1913, basic thereafter. The monthly price is an average of prices on Tuesday of each week. Great Britain: Scotch, to 1904, Cleveland No. 3 thereafter. The monthly price used is that quoted in the *Monthly Trade Supplement* of the *London Economist.*
Cotton, spot:	United States: middling upland, N. Y. The monthly price is an average of closing prices on Tuesday of each week. Great Britain: middling upland, Liverpool. The monthly price used is the closing price on the first or near the first of each month, as given in the *Commercial and Financial Chronicle.*
Cotton yarn:	United States: carded cones, 10/1; average monthly price. Great Britain: 32's, cop twist, Manchester. The monthly price used is the low for the first week of each month, as given in the *Commercial and Financial Chronicle.*

These figures indicate that spot cotton prices are subject to more frequent change in the United States than in England, but that pig iron and cotton yarn prices in this country change less frequently than in England. The pig iron figures are in notable contrast to those in Table 73. The measures of monthly variability show pig iron to be distinctly more variable in price in the United States than in Great Britain. (The American figure is 6.5, as compared with 4.3 for Great Britain.) Yet the British price changes much more frequently than the American price. (The British index is .94, as compared with an American index of .77, where a value of 1.00 would indicate a change during every one of the months covered.) There is no contradiction here, however. It is probable that the ready response of British pig iron prices to changing market conditions, evidenced by the high index of frequency of change, results in a decrease in the magnitude of monthly price fluctuations.

Since the American cotton and cotton yarn prices are averages of weekly prices, while the British monthly prices relate to specific dates, comparability is not perfect for these commodities. The averaging would hardly reduce the frequency of change, however, so that the lower cotton yarn figure for the United States is probably not attributable to this difference.

3. Regional Differences in Commodity Price Trends

In the section devoted to the trends of commodity prices marked differences were found in the rates at which individual commodities had changed in price between 1896 and 1913, though the general index had increased during this period at a uniform annual rate. The economic importance of these differences was suggested. A question now arises as to whether these differences are due entirely to characteristic differences between commodities, or whether there are significant differences between the rates at which the price of a single commodity changes in different regions. The behavior of certain farm prices in this respect may be first considered.

TABLE 77

Regional Differences in Commodity Price Trends, 1896-1913

A. Comparison of Trends of Farm Prices of Corn in Ten States

B. Comparison of Trends of Farm Prices of Oats in Ten States

(1) State	(2) Average annual rate of increase in price, 1896-1913[1] percent	(3) State	(4) Average annual rate of increase in price, 1896-1913[1] percent
Texas	3.7	California	1.8
Tennessee	4.2	Texas	3.2
Kentucky	4.4	Minnesota	3.6
Ohio	4.5	South Dakota	3.7
Minnesota	4.6	Ohio	3.9
Indiana	4.7	Indiana	3.9
Illinois	4.9	Illinois	3.9
Missouri	5.2	Wisconsin	4.0
Iowa	5.4	Iowa	4.1
Nebraska	5.9	Nebraska	4.7
United States	4.8	United States	3.5

[1] The prices employed in deriving these values were December 1st farm prices.

This table reveals very considerable differences in the behavior of farm prices in different parts of the country. The rate of increase in the price of corn at the farm has varied from 3.7 per cent in Texas to 5.9 per cent in Nebraska. The rate for oats has varied from 1.8 per cent in California to 4.7 per cent in Nebraska. Reasons for these differences may be found in the relations between prices and production, in cheapening transportation costs, or in other factors. Improvement of transportation and lowering of freight charges have undoubtedly tended to equalize prices, and one effect of such equalization would be the varying rates of increase which are here shown.[1] While such differences constitute additional complexities in the price structure, their recognition simplifies the process of analyzing that structure, and enables the behavior of its component parts to be more readily understood.

International differences of the same sort are shown by the following table. Certain of the data are plotted in Figure 20.

TABLE 78

Comparison of Price Trends of Sixteen Commodities in Four Countries*

(1) Commodity	(2)	(3)	(4)	(5)
	Average annual rates of change in price, 1896–1913			
	United States percent	Great Britain percent	Germany percent	France percent
Wheat	2.6	1.7	2.0	1.5
Rye	4.1		2.0	
Potatoes	4.3	—.4	2.7	4.4
Sugar, raw	.2	1.2	.4	
Sugar, refined	.1		—1.2	2.9
Cotton, raw	3.9	3.8	3.8	3.9
Cotton yarn	2.6	3.1	3.1	
Pig iron	1.0	1.7	—.2	
Copper	1.0	1.5	1.0	
Coal, bituminous	.9	1.1	1.7	1.9
Petroleum	3.5	—.2		2.2
Wool	1.6	1.5		
Silk	—.1	—.1		
Rubber	2.3	3.7		
Hides	3.4	3.2		
Coffee	2.7	—2.4		-.1

*For descriptions of the price quotations employed see the note to Table 71.

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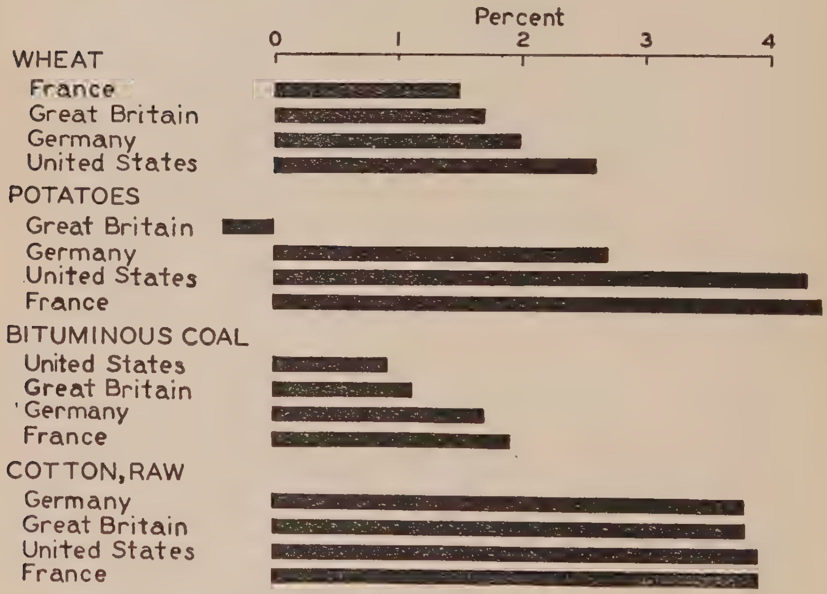
[1] The presence of a tendency toward equalization is evidenced by the measures of regional differences in farm prices (in percentage form) given in Table 65. This measure for corn declined from 22.8 for the period 1890-1897 to 17.1 for the period 1906-1913. For oats, the decline was from 20.8 to 17.1.

FIGURE 20

INTERNATIONAL DIFFERENCES IN COMMODITY PRICE TRENDS.

Comparison of Four Commodities in Four Countries in respect to Average Annual Rates of Change in Wholesale Prices from 1896 to 1913.



Explanation of the differences revealed by Table 78 would call for a detailed comparison of the several countries in respect to their industrial development between 1896 and 1913. No such comparison can be attempted. The significant fact, for the present purpose, is that there are distinct differences in the price trends of identical commodities in different countries. Raw cotton is conspicuous in that the rates of increase have been almost identical in all four countries. The reason for the resemblance is found, probably in the fact that cotton prices are fixed in an international market. At the other extreme stand potatoes, for which the rate of change varies from −.4 per cent, in England, to 4.4 per cent, in France. The price of potatoes in each country is largely determined by domestic conditions. Wheat, though resembling cotton in respect to the scope of the market, has increased in price at varying rates in the four countries compared. The rate was lowest in France and greatest in the United States. One factor responsible for the sharper rate of increase in American prices is probably found in the diminishing surplus available for export from this country, though tariffs and changing transportation charges have doubtless played a part.

There is apparent no tendency, such as was observed in studying the variability measures, for the rates of change, considered collectively, to be greater in any one country than in the others.

4. Regional Differences in the Cyclical Movements of Commodity Prices

There is a promising and hitherto largely unexploited field for research in the investigation of differences from market to market and region to region in the cyclical movements of commodity prices. That there are important differences is revealed by even a slight study of the field. Just as commodities differ in the timing, amplitude and duration of their cyclical swings, so do quotations relating to the same commodity but drawn from different regions. In the present account it is possible to do no more than indicate the type of results which may be expected.

The monthly quotations of tank wagon gasoline prices drawn from 14 cities over the period 1919-1925 will furnish illustrative material.[1] The period covered is brief and the commodity is not in all respects suitable, but the data will serve our present purpose.

We may follow the movements of gasoline prices in these 14 cities in the recession of 1920, the revival of late 1921 and early 1922, the recession of late 1922 and early 1923, and the revival of 1924. We thus have four turning points and the periods between for study. The sequence of change at each of these turning points is shown in the table on the next page.

For the group of cities here included the first recession began in Birmingham in August, 1920, three months after the date of the highest point attained by the general wholesale price index. Southern cities felt it first, then came a general down-turn on the Eastern seaboard and in the Middle West. Not until February, 1921, nine months after the high of general prices, did the recession in gasoline prices begin on the Pacific Coast. There was a six months interval between the recession in Birmingham and the turn on the Pacific Coast. The average date of recession in the 14 cities came 7.1 months after the reference date.

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[1] The prices are for tank wagon gasoline, at wholesale (less taxes), as quoted in the *National Petroleum News*. Each monthly price is that for a single date near the first of the month.

TABLE 79

Regional Differences in the Sequence of Recession and Revival in Tank Wagon Gasoline Prices, at Wholesale[1]

A. Sequence of Recession, 1920-21 (Ref. date, May, 1920)

B. Sequence of Revival, 1921-22 (Ref. date, January, 1922)

City	Date of high preceding recession	City	Date of low preceding revival
Birmingham	+3	Birmingham	—3
El Paso	+4	El Paso	—3
Atlanta	+6	Atlanta	—3
Oklahoma City	+6	Pittsburgh	—3
Denver	+7	Detroit	—3
Pittsburgh	+7	Kansas City	—3
Boston	+8	Omaha	—3
New York	+8	Oklahoma City	+3
Detroit	+8	Denver	+3
Kansas City	+8	Boston	+3
Omaha	+8	New York	+3
Los Angeles	+9	Los Angeles	constant
San Francisco	+9	San Francisco	constant
Seattle	+9	Seattle	constant
Average	+7.1	Average	— .8

C. Sequence of Recession, 1922-23 (Ref. date, April, 1923)

D. Sequence of Revival, 1923-24 (Ref. date, June, 1924)

City	Date of high preceding recession	City	Date of low preceding revival
El Paso	—9	Detroit	—6
Atlanta	—9	Kansas City	—6
Pittsburgh	—9	Denver	—6
Detroit	—9	Atlanta	—5
Kansas City	—9	Los Angeles	—5
Omaha	—9	San Francisco	—5
Oklahoma City	—9	Seattle	—5
Denver	—9	Boston	+4
Boston	—9	New York	+4
New York	—9	Oklahoma City	+5
Birmingham	—8	Pittsburgh	+6
Los Angeles	—8	El Paso	+6
San Francisco	—8	Birmingham	+7
Seattle	—8	Omaha	+7
Average	—8.7	Average	+.1

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[1] In this table the figures measure deviations, in months, from the origin. The sign (—) indicates that the turn in price occurred before the date serving as origin. The sign (+) indicates that the turn occurred after that date.

The turn upward, which was generally reflected in wholesale price movements after the depression of 1921, appears in the prices of gasoline in 11 of these 14 cities. In 7 cities prices rose 3 months before the reference date and in 4 cities prices rose 3 months after this date. The average date of turn, for these 11 cities, came .8 of a month before the reference date.

The recession of prices which was general in 1923 appears in the movement of gasoline prices from 8 to 9 months before the turn in the wholesale price index. The movement was practically synchronous in the 14 widely separated cities from which the present price quotations have been drawn. The average date of turn came 8.7 months before the reference date, when general prices started downward.

There is more diversity in the dates of revival in 1923 and 1924. Although the price revival was felt in all these cities, there was an interval of 13 months between the turn in Detroit and the turn in Omaha. The sequence shown in Table 79-D does not suggest any clear regional grouping in respect to the date of the price turn. The average date of turn, in these 14 cities, came .1 of a month after the turn in the general price index.

Differences between the movements of prices in different regions are not limited to differences in the dates at which price turns are felt. Other aspects of cyclical price behavior are summarized in the tables which follow. Only brief comments are appended.

TABLE 80

REGIONAL DIFFERENCES IN CYCLICAL MOVEMENTS OF TANK WAGON GASOLINE PRICES, AT WHOLESALE[1]

A. Duration of Fall, 1920-22. B. Percentage of Fall, 1920-22.

City	Duration of fall (in months)	City	Percentage of fall (percentage of high price preceding recession)
Detroit	9	New York	22.6
Omaha	9	Boston	25.0
Kansas City	9	Pittsburgh	31.4
Pittsburgh	10	Atlanta	36.7
Atlanta	11	Omaha	37.3
El Paso	13	Denver	37.5
Birmingham	14	Detroit	37.9
Boston	15	Birmingham	39.7
New York	15	Kansas City	40.8
Denver	16	Oklahoma City	44.8
Oklahoma City	17	El Paso	48.4
Average	12.5	Average	36.6

TABLE 80 (Cont.)

C. Duration of Rise, 1921-22. D. Percentage of Rise, 1921-22.

City	Duration of rise (in months)	City	Percentage of rise (percentage of low price preceding revival)
Boston	3	Boston	12.5
New York	3	New York	12.5
Denver	3	Birmingham	21.0
Oklahoma City	3	Pittsburgh	23.8
Atlanta	9	Denver	25.0
Detroit	9	Omaha	27.0
El Paso	9	Detroit	30.7
Kansas City	9	Atlanta	36.8
Omaha	9	Kansas City	36.9
Pittsburgh	9	Oklahoma	37.5
Birmingham	10	El Paso	43.7
Average	6.9	Average	27.9

E. Duration of Fall, 1922-24. F. Percentage of Fall, 1922-24.

City	Duration of fall (in months)	City	Percentage of fall (percentage of high price preceding recession)
Denver	17	Birmingham	43.5
Detroit	17	Pittsburgh	46.2
Kansas City	17	New York	48.2
Atlanta	18	Kansas City	49.3
Boston	27	Boston	51.9
New York	27	El Paso	52.2
Oklahoma City	28	Omaha	53.2
Pittsburgh	29	Detroit	53.9
Birmingham	29	Denver	56.0
El Paso	29	Oklahoma City	56.8
Omaha	30	Atlanta	57.7
Average	24.4	Average	51.7

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[1] The three Pacific Coast cities are omitted from this table, since there was no price rise in these cities immediately following the recession of 1920-21.

It is significant that the percentage of fall from 1920 to 1922 was least in the large eastern cities which are far removed from the sources of supply, while the fall was greatest in two cities close to important extractive centers. A similar relationship prevails among the figures showing the percentage of rise during 1921 and 1922.

In order to compare the three Pacific Coast cities with the other cities, in respect to price movements during the major recession which extended from 1920 to 1924, the following table has been prepared. In computing these measures the fairly short revival of 1921-22 has been ignored and account has been taken only of the major down-swing from the latter part of 1920 to 1924.

TABLE 81

REGIONAL DIFFERENCES IN CYCLICAL MOVEMENTS OF TANK WAGON GASOLINE PRICES, AT WHOLESALE

A. Duration of Fall from the Recession of 1920-21 to the Revival of 1924 B. Percentage of Fall from the Recession of 1920-21 to the Revival of 1924

City	Duration of fall (in months)	City	Percentage of fall (percentage of high price preceding recession)
Los Angeles	35	Pittsburgh	54.3
San Francisco	35	New York	54.8
Seattle	35	Seattle	57.2
Detroit	35	Birmingham	58.7
Kansas City	35	Kansas City	58.9
Denver	36	San Francisco	59.3
Atlanta	38	Boston	59.4
Boston	45	Detroit	62.5
New York	45	Omaha	62.7
Oklahoma City	48	Los Angeles	63.0
Pittsburgh	48	Atlanta	63.4
Omaha	48	El Paso	64.5
El Paso	51	Denver	65.6
Birmingham	53	Oklahoma City	67.3
Average	41.9	Average	60.8

The results given in the preceding tables are summarized in the table on next page in a form convenient for comparison with similar measures for other commodities.

If our interest relates to the United States as a unit, the averages in Table 82 describe the cyclical behavior of gasoline prices more faithfully than would measures based upon a series of prices drawn from a single market. The averages must be interpreted, however, in connection with the standard deviations in the last column. The first four standard deviations measure the degree of association, in time, between gasoline price movements in different cities at four important turning points. The regional differences were least (standard deviation = .7 mo.) during the recession which began about the middle of 1922. The differences between markets were greatest (standard deviation = 5.6 mos.) during the price revival which occurred between December, 1923, and January, 1925.

TABLE 82

CYCLICAL MOVEMENTS OF TANK WAGON GASOLINE PRICES, AT WHOLESALE, 1920-1924

AVERAGES AND MEASURES OF REGIONAL DIFFERENCES

(1) Measure	(2) No. of cities	(3) Arithmetic mean of measures relating to individual cities	(4) Standard deviation of measures relating to individual cities
1. Date of high, 1920-21	14	+ 7.1[1]	1.9
2. Date of low, 1921-22	11	— .8[1]	2.9
3. Date of high, 1922-23	14	— 8.7[1]	.7
4. Date of low, 1923-24	14	+ .1[1]	5.6
5. Duration of fall, 1920-22	11	12.5	3.1
6. Percentage fall, 1920-22	11	36.6	7.1
7. Duration of rise, 1921-22	11	6.9	3.0
8. Percentage rise (as percentage of low), 1921-22	11	27.9	9.9
9. Duration of fall, 1922-24	11	24.4	5.3
10. Percentage fall, 1922-24	11	51.7	4.5
11. Duration of fall, 1920-24	14	41.9	6.9
12. Percentage fall, 1920-24	14	60.8	4.2

[1] For the reference dates to which these measures relate, see Table 79.

The various other standard deviations are to be interpreted in a similar fashion. Without attempting further analysis we may conclude that there are material differences between markets in respect to the behavior of wholesale gasoline prices during business cycles, differences as great as many of those which have been noted in comparing commodities. In computing these measures of regional difference we have dealt with a commodity which is fairly well standardized in quality, and the prices employed have been those quoted by a relatively small group of companies. There is no reason to doubt that similar regional differences in the price behavior of a great many commodities would be found if a general study of this character were made. There is an important field for exploration in the study of the regional incidence of business cycles, as well as in the study of their industrial incidence.

The utility of measures of the type presented in Table 82 may be illustrated by a comparison of such results for two different commodities. This comparison has been worked out on a very limited scale, but it will serve as an example. In the following table are given measures relating to the cyclical behavior of gasoline prices and Portland cement prices, at wholesale, during the cyclical swings of general business between 1920 and 1924. The data cover one major cycle, from the high which centered in 1920 to the high centering in 1923. The measures compared were computed, in each case, from price data for the same cities, which varied in number from 6 to 10.[1]

TABLE 83

COMPARISON OF GASOLINE AND PORTLAND CEMENT PRICES IN AMERICAN CITIES, IN RESPECT TO REGIONAL DIFFERENCES IN CYCLICAL MOVEMENTS†

(1) Measure	(2) No. of cities	(3) Arithmetic means of measures relating to individual cities	(4)	(5) Standard deviations of measures relating to individual cities	(6)
		Gasoline	Portland cement	Gasoline	Portland cement
1. Date of high, 1920-21	10	+ 7.9*	+ 8.5*	.9	4.3
2. Date of low, 1921-22	7	— .4*	+ 3.3*	3.0	5.0
3. Date of high, 1922-23	9	— 8.7*	+ 6.3*	.5	4.9
4. Duration of fall, 1920-22	7	12.1	16.1	3.0	4.5
5. Percentage fall, 1920-22	7	33.1	32.8	6.6	11.8
6. Duration of rise, 1921-23	6	7.0	15.7	2.8	3.3
7. Percentage rise (as percentage of low), 1921-23	6	25.5	19.6	10.3	6.9

†The gasoline prices employed are those for tank wagon gasoline, at wholesale (less taxes), as quoted in the *National Petroleum News*. Prices are for dates near the first of each month. Portland cement prices are taken from the section on Portland cement in *Mineral Resources of the United States*, published by the U. S. Geological Survey.

*For the reference dates to which these measures relate, see Table 79.

Differences between the averages for gasoline and cement in the above table possess some interest, but our present purpose is the comparison of these commodities in respect to regional differences in their price movements. Our attention centers, therefore, on the standard deviations. With only one exception the regional differences in cyclical price behavior have been materially less for gasoline than for Portland cement. The price turns in the different cities during the three major turns covered by the first three entries were much closer together in time for gasoline than for cement. This is particularly marked for the first and third entries, in which standard deviations of .9 and .5 for gasoline are paired with values of 4.3 and 4.9 for cement. (The smaller the standard deviation, of course, the less are the regional differences and the more compact are the price movements in question.) Among the seven cases here covered, differences from market were greater for gasoline than for cement only in respect to the last entry, showing the percentage rise from the low of 1921-22 to the high of 1923-24. The rise was greater for gasoline than for cement (25.5 per cent as compared with 19.6 per cent) and the regional differences were materially greater for gasoline (standard deviation of 10.3, as compared with 6.9 for cement).

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[1] The ten cities were Atlanta, Boston, Denver, Detroit, Kansas City, Los Angeles, New York, Pittsburgh, San Francisco, Seattle. Three of these (Los Angeles, San Francisco and Seattle) were omitted in computing the measures covered by the second, fourth and fifth entries, because the rise of 1921-22 in general prices was not reflected in gasoline prices on the Pacific Coast. One city (Denver) was omitted in computing the measures covered by the third entry, since there was no recession in Portland cement prices in that city during the general downward movement of 1923-24. Four cities (the three Pacific Coast cities and Denver) were omitted in computing the measures covered by the sixth and seventh entries.

An objection may be raised to this procedure of omitting the cities which did not share in the particular movement being studied. That prices in a given city were not affected is an important and thoroughly relevant fact, which must be noted. But account cannot be taken of it in computing the statistical measures presented. These are to be interpreted as describing the behavior of prices in those cities which were affected by the general movement. In each case precisely the same cities are included for the two commodities, hence there is a reasonable basis for comparison.

Adequate data would permit extensive comparison of commodities according to some such scheme as that outlined above. The data at present available permit only fragmentary studies of the type illustrated.

5. Regional Differences in the Flexibility of Commodity Prices

That there exist regional differences in the flexibility of prices was pointed out by Henry L. Moore in his important memoir "Elasticity of Demand and Flexibility of Prices."[1] Holbrook Working has given a specific example of regional differences in elasticity of demand, the commodity being potatoes and the markets Cincinnati and St. Paul. In terms of prices at St. Paul the elasticity of demand for potatoes varied from .36 at a consumption of 80 per cent of normal to .57 at a consumption of 120 per cent of normal. In terms of Cincinnati prices the elasticity ranged from .41 at a consumption of 80 per cent of normal to .78 at a consumption of 120 per cent of normal.[2]

In an earlier section[3] the relation between the price and production of tame hay in the United States was described. We may determine whether there are material differences from state to state in the flexibility of hay prices and in the other basic measures used in defining the relationship between prices and quantities. In studying these relations by states it has been necessary to employ data which differ somewhat from those used in the broader study. For each of six states the average relationship between the December 1st farm price of hay and the average yield of hay per acre during the preceding year was measured.[1] Prices were deflated by the wholesale price index of the Bureau of Labor Statistics. Data for the period 1890-1925 were employed. The results are given in the following table. The symbol *Y* is used for link relatives of deflated prices and *X* for link relatives of yield.

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[1] "It is always necessary to specify the market for which the empirical laws of demand apply. The values of ϕ and η vary from market to market." *Journal of the American Statistical Association*, March, 1922.

[2] "The Statistical Determination of Demand Curves," *Quarterly Journal of Economics*, August, 1925.

[3] See pp. 144-147.

TABLE 84

MEASURES DEFINING THE RELATIONS BETWEEN DECEMBER FARM PRICES OF HAY AND YIELD PER ACRE, IN SIX STATES.

(1) State	(2) Equation of relationship	(3) Standard error of estimate (in percentage form)	(4) Coefficient of correlation	(5) Coefficient of determination	(6) Coefficient of flexibility
California	log Y=2.80539 —.40323 log X	25.6	—.27	.07	—.40
Iowa	log Y=3.15261 —.57601 log X	16.0	—.68	.46	—.58
Ohio	log Y=3.55814 —.78012 log X	17.7	—.73	.54	—.78
Wisconsin	log Y=3.72212 —.85963 log X	13.6	—.79	.63	—.86
Pennsylvania	log Y=3.77909 —.88819 log X	14.1	—.74	.54	—.89
New York	log Y=3.86301 —.93123 log X	15.5	—.77	.59	—.93
United States*	log Y=3.93434 —.96454 log X	10.7	—.73	.53	—.96

*The variables in this case are crop year averages of Chicago wholesale prices and total United States production.

The measures derived in describing the relation between Chicago wholesale prices of hay and total production in the United States are included in this table, although they are not directly comparable to the measures relating to the separate states.

The coefficients of correlation between December farm prices and yield per acre vary from –.27 for California to –.79 for Wisconsin. California stands by itself at the lower extreme, since the coefficients for all the other states lie between –.68 and –.79. There is a corresponding variation in the coefficients of determination. On the reasonable assumption of a causal relationship between yield per acre and farm price, these coefficients indicate that in four of the six states covered above variations in yield per acre account for more than 50 per cent of the squared variability of deflated prices. The two states with coefficients below .50 are California with .07 and Iowa with .46.

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[1] Price and yield figures were obtained from the *Yearbooks* of the Department of Agriculture.

The farm price of hay appears to be inflexible in all the states named. The price is least flexible in California, for which the coefficient is −.40, and most flexible in New York, for which the coefficient is −.93. This latter figure is very close to the figure −.96, obtained in the general analysis relating to total domestic production and Chicago prices.

III Conclusion

The first part of the present chapter contains measures of regional variations in price for a number of building materials and for gasoline, at wholesale, for a diversified list of foods, fuels and dry goods at retail, and for seven important agricultural products, as priced at the farm. Similar measures for discount rates have been presented for the purpose of comparison. The *mean deviation*, both in absolute form and as a percentage of the mean, has been used as a measure of regional variations. The second half of the chapter deals with differences from city to city, from state to state, and from country to country in the behavior of prices. Measures relating to all the aspects of price behavior which were described in the first chapter are compared in this survey of regional differences.

The various examples given in this chapter indicate the degree of diversity in price movements found within the United States. There is diversity not only in respect to the absolute prices prevailing at a given time, but there appear to be wide differences in the price behavior of identical commodities in different markets. The materials here presented have been fragmentary, but scattered as the examples have been they furnish conclusive evidence that the United States cannot be treated as a single homogeneous market in a study of the structure of prices. If the United States is to be treated as a unit in measuring changes in the price level and in dealing with other aspects of the behavior of prices in combination, it can only be done on the basis of adequate regional sampling, with full recognition of existent regional diversities.

Such regional differences in one aspect of price behavior—degree of change between given dates—have been touched upon by several writers in connection with the measurement of changes in the price level. F. Y. Edgeworth has pointed out, in his classic *Memoranda* (1887-89), that differences of this type "may well be inconsistent with the hypothesis of a unique and general mean type"—a suggestion which bears upon all plans looking toward the stabilization of the price level.

The measures of regional difference presented in this chapter have been given without attempted explanations of the observed variations in prices and in price behavior. In this form they solve no problems, but they raise important questions which the economic theorist must face. The differences between the absolute prices prevailing in different markets doubtless represent the net effects of a number of factors. To what extent may we account for these differences? Are there specific market areas within which substantially uniform prices prevail? What are the limits of such market areas for specific commodities? What elements of price difference remain after the crude differences have been corrected for explicable elements? Again, what are the economic and social factors responsible for observed differences in the behavior of prices in different markets? The elements of a given economic structure cannot be clearly defined, nor may the working of such a system be fully understood, until the most important regional differences in prices and in price behavior have been explained.

It has been the first object of the present study to isolate for detailed analysis certain characteristics of commodity prices which appear to have definite economic significance and which are capable of numerical description. Half a dozen such characteristics have been selected for study, and appropriate methods of description have been derived. Several related measures have been employed in the analysis of certain types of price behavior, so that we have approximately a dozen measures descriptive of the behavior of each commodity we have studied in detail.

Differences in the behavior of individual commodities are reflected in wide variations in the values of these measures. Comparison of the measures relating to individual commodities and study of the points of resemblance and difference yield information of considerable interest. Differences in the price movements of commodities which differ in their organic nature, in the uses to which they are put, or in any other important economic characteristic, may be noted. Related commodities may be followed through the various productive and distributive stages, and changes in behavior resulting from changes of form and market observed.

The various measures presented have been arranged in such form as to facilitate these comparisons. The emphasis throughout has been upon the characteristics of individual commodities and markets, and upon resemblances and differences between commodities and between markets. No attempt has been made to draw general conclusions, except such as might be derived incidentally from the measures relating to individual commodities and markets and from the relations between them. We must now go beyond these individual measures and search for such general tendencies and general relations as may be found in the behavior of grouped observations. In combining and averaging the measures which have been described in this section various avenues of approach may be tried. Certain of these are explored in the next two chapters.

CHAPTER III

THE MEASUREMENT OF PRICE INSTABILITY PRICE RELATIVES IN COMBINATION

I Price Relations and Economic Processes

Price Instability

In the interpretation of measures descriptive of the behavior of prices of individual commodities, one naturally compares them with similar figures relating to other commodities. This tendency to compare arises from inherent relations between commodity prices. An individual price has significance only in its relations to other prices. These relations, and changes in these relations, play a vital part in economic processes.

1. The Price System

The broadening of the approach to the study of prices which has characterized work in this field in recent years is due in large part to the introduction of the conception that prices constitute a unified, coherent system.[1] This conception emphasizes the fact that no one price is an isolated, independent phenomenon. From each price lines of relationship run out to all other prices coeval with it in time and back to previous prices, while similar lines run forward to affect future price quotations. Every price is connected by immediate or remote bonds to every other price.

Within the broad system of prices which is formed by this infinity of ties there are numerous elements. Each of these may, perhaps, be viewed as a minor price system, with characteristic features and modes of behavior. For an understanding of the price system as a whole it is necessary to isolate these separate elements, studying them individually and in relation to the whole system. The elements entering into the complex net which is the price system are not, of course, restricted to commodity prices. The prices of human services, of land, of capital and credit, the prices of business enterprises themselves, constitute elements of the price system, and each of these has unique features. The present study is confined, with minor exceptions, to the system of commodity prices.

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[1] In the form in which it is here presented this conception is due to Wesley C. Mitchell. The role of prices in economic life and the numerous bonds which tie into a well-articulated system the multitude of prices of individual commodities and services are described by Dr. Mitchell in *Business Cycles: The Problem and Its Setting* (National Bureau of Economic Research, 1927), pp. 108-116. Léon Walras, in describing the conditions of general economic equilibrium, defined in mathematical terms certain characteristics of a system of related prices. In the Walrasian system prices are one element in general economic equilibrium.

This system is never at rest. It is a changing organism, with its parts constantly altering their relations to each other. An account of the working of the price system must, therefore, be a dynamic one. Change is of the essence of the relations which are here studied.

The remainder of the present volume and all of the volume which will conclude the present study deal with the system of prices. For a study of the behavior of prices in combination is a study of the price system. Interest attaches to the behavior of prices in combination because of the immediate economic significance of changes in the net-work of relations which tie prices together. Such changed relations disturb (or reflect changes in) that equilibrium between prices which prevails when there is an uninterrupted functioning of economic processes. These disturbances are discussed in the next section.

2. THE NATURE OF PRICE STABILITY AND INSTABILITY

The analysis of price relatives in combination may be looked upon, in one of its most important aspects, as a study in price instability. This term and its companion, price stabilization, are used in a somewhat loose fashion in current discussion. Some precision may be gained by distinguishing between three fairly distinct, though related, meanings which may be attached to price instability. The first relates to what is commonly called the general level of prices, the second to relations between individual commodity prices and groups of prices, the third to the characteristics of frequency distributions of price relatives.

a. *Instability of the Price Level.* In so far as the term price stability has a definite and generally accepted meaning in current usage, it refers to the general level of prices. A fairly uniform price level, such as that which prevailed in the United States between 1909 and 1915, is considered to be stable, while a fluctuating price level, similar to that prevailing between 1916 and 1921, is said to be unstable. Price instability of this kind is measured by index numbers of the usual type.

The economic and social effects of such fluctuations in general prices have been discussed elsewhere in considerable detail, and extensive programs looking toward the stabilization of the price level have been formulated. Later detailed discussion will bear in part upon the measurement of such instability, and upon the relations between instability of this type and other forms of price instability.

b. *Internal Instability: Alterations in the Relations among Prices.* The changes in prices which are matters of immediate concern to producers and consumers of goods and to recipients of money incomes are those which affect the relations between different elements in the price system. By internal instability is meant that form of price instability which develops when a set of established price relations is disturbed. When buying and selling relations at any point in the market are altered, economic equilibrium is disturbed and some element of instability is introduced. Such instability is obviously not unrelated to the changes in the price level which were mentioned in the preceding paragraph. In fact, the practical effects of an unstable price level upon the economic system appear through changes in established price relations. The force, or combination of forces, which raises or lowers the general price level does not affect all elements in the price system at the same time nor in the same degree. Internal instability is in part, at least, a result of an unstable price level. The two types of instability are sufficiently independent of each other, however, to require separate treatment.

Alterations in price relations may be due to changes in the quantity of money in circulation, to changes in manufacturing and marketing methods, to a temporary shortage or surplus of goods, to any of the thousand factors that affect economic processes. The causes of internal instability are not, of course, found exclusively in the price system itself. Perhaps the chief causes are external to that system. To the extent that external causes are responsible, prices constitute merely the medium in which changes in market relations are reflected. Back of changing price margins and shifting price ties are alterations in economic relationships, alterations which may be slight or profound. These are the ultimate objects of interest.

It may not be altogether accurate to describe by the term price instability the condition which develops when established price relations are altered, for such price relations are always changing. What constitutes a "normal" rate of change is something to be determined. In the meantime the measures of internal instability should be thought of as measures of the degree of change in price relations. The rate of change may be such as to indicate marked instability at certain times, while at other times the measures of instability may approach the values which indicate a perfectly static condition, with unchanging economic relations. The proper interpretation of the measures to be secured is, of course, one of the matters with which we shall be concerned.

The problem of defining and measuring all the shifts in price relationships which contribute to, or which reflect, internal instability is probably not capable of definitive solution. Three types of internal movements which are capable of measurement have a bearing on such dislocations. These are:

(a). The dispersion of prices, due to the varying degrees of change in individual commodity prices between given dates.

(b). The shifting of relative position, or displacement of prices. (The difference between dispersion and displacement is discussed in a later section.)

(c). Long-term shifts in relationship, due to differences in the secular trends of individual commodity prices. The significance of such changes in relationship was briefly discussed in Chapter I, in connection with the measurement of average annual rates of price change.

c. *The Population of Prices and the Problem of Group Stability.* The types of instability dealt with above relate to changes in the general price level and to changes in the relations among individual prices. The third form of instability to be investigated is a group attribute, as is the first, but an attribute of a different order. In defining it we deal with the entire population of prices as an organic entity. We may study the characteristics of this group just as we would study the characteristics of any population. As we might inquire concerning a biological group, so we may ask of the population of prices: Is this population homogeneous? Is it subject to the play of balanced forces, with the tendency toward individual variation held in check by stabilizing factors? Or is it heterogeneous, marked by wide and sporadic variation, subject to the play of forces which are limited in number or unbalanced in their incidence? These questions bear directly upon the stability of the price system itself, and upon its utility and reliability as an economic instrument. The fuller development of this theme, and the attempt to answer some of these questions, may be postponed until more detailed attention has been given to the measurement of changes in the price level, to the study of price dispersion and to the analysis of price displacement.

There is, of course, a close relation between the problem of price stability and that central problem of economic theory which is concerned with general economic equilibrium. In studying price instability we are dealing with the monetary aspects of this classical problem. The relationship between the movements of prices and the equilibrium of economic forces has been suggested by many writers, although there is a sharp difference of opinion as to the direction in which the chain of cause and effect runs. There are those who look upon the price system as the source of major disturbances, there is an opposing view that price instability is merely a reflection of more fundamental disturbances of economic equilibrium, while a third group would stress the mutual dependence of price and non-price factors. This particular problem is not one which concerns us at present.

3. Problems Relating to Commodity Prices in Combination

Certain of the problems connected with prices in combination have been indicated above. A brief summary, in more specific form, of the matters which will be considered in the present and the following chapters will indicate the scope of this treatment.

The first measures to be studied in combination will be those relating to price changes between specific dates—link and fixed base relatives of the usual type. This study will be confined largely to the behavior of prices in wholesale commodity markets.

The analysis of such measures is not a new procedure in economic research. An extensive literature has been built up about this subject, and there have been warm discussions concerning the problems to be solved and the methods to be employed in such studies. The questions which have engaged the attention of students in this field have been set for them, as in all studies, by contemporary interests and contemporary economic problems. Although interests and problems have changed somewhat since serious study of prices was begun, a single issue has been dominant. This issue is clearly set forth in the titles to certain of the fundamental memoirs. Jevons' pioneer study (1863) was called *A Serious Fall in the Value of Gold Ascertained.* Edgeworth's *Memoranda* to the British Association for the Advancement of Science in 1887-8-9 dealt with "variations in the value of the monetary standard." In 1901 C. M. Walsh published his comprehensive book, *The Measurement of General Exchange Value*, and in 1911 Irving Fisher's work *The Purchasing Power of Money* was issued. The same central problem appears in works primarily concerned with the methodology of the subject, such as Mitchell's *Making and Using of Index Numbers* and Fisher's *Making of Index Numbers.* The earliest important studies in this field were undertaken to measure the effect upon general prices of changes in the volume of gold production. This interest has persisted, and the major purpose in constructing index numbers of prices has remained to this day the measurement of changes in the price level, or changes in the purchasing power of money. The object, that is, has been the study of the first type of price instability described above.

Though this interest in the "general level of prices" has been dominant, other aspects of the behavior of price relatives have received attention from students in this field. The widening of the sphere of interest is, in part, the outgrowth of technical studies relating to methods of index number construction. Jevons, Edgeworth and all their successors found it necessary, in deciding upon appropriate methods of measurement, to study frequency distributions of price relatives, and this study has drawn attention to aspects of such distributions other than their central tendencies. Again, the recognition that an index number must of necessity be based upon a sample set of price quotations raised questions concerning the procedure to be followed in securing a representative sample. The tendency toward a broader approach to the study of price behavior which is attributable to these studies in method has been reënforced by other considerations. Specific information concerning particular groups of commodities has been desired. There has been, besides, a growing appreciation of the economic importance of the price relations between different commodities and services. The conception of prices as a system has been introduced, and the internal structure of this sytem has become an object of scientific inquiry. Once the significance of this conception is appreciated, it is clear that no single index number of commodity prices can yield the information concerning the behavior of prices and the shifts in price relations which economists and business men require. For many important aspects of price behavior quite elude measurement by such an index.

Among the objects of study in a survey of the price system are those other types of price instability described above—instability of internal relations, and group instability. Measures of the dispersion and displacement of price relatives must be constructed, and account must be taken of those long-term shifts which are due to differences in trend. In the study of group stability and homogeneity we shall be concerned with the attributes of frequency distributions of price relatives. In approaching this problem we lose sight of individual commodities and our sole interest attaches to the attributes of the entire population, considered as an entity.

Somewhat similar problems present themselves when we pass from price relatives to other measures of price behavior. We shall study cyclical measures and measures of variability and trend in combination, again seeking information concerning the group attributes of prices. It would be desirable to analyze in the same way collections of measures of price flexibility and of regional price differences, but the available figures are too limited in number to permit of generalizations concerning group behavior. The study of such measures in combination must wait upon the assembling of the necessary data.

The final stage of the study, and the most important from the point of view of one interested in the elements and internal structure of the price system, is the isolation and analysis of price groups and the testing of various grouping principles. The data described in the present volume furnish some of the basic materials for such an analysis. The detailed account of this part of the study is deferred to a second volume.

II The Description of Price Relatives in Combination

The present chapter deals with the first of the measurable characteristics of commodity prices which were discussed at an earlier point—degree of change in price between specific dates. The first step in the study, in combination, of the relatives which measure these changes is their organization in the form of frequency distributions.

1. Frequency Distributions of Price Relatives

Distributions of price relatives may be constructed in a number of different forms, representing various combinations among measures of the following types:

(a). Fixed base and link relatives
(b). Unweighted and weighted relatives
(c). Relatives in natural and in logarithmic form

It will be desirable to compare the results secured from the employment of certain of these alternative methods.

To facilitate the study of distributions of fixed base relatives the interval covered has been broken up into three periods: 1891-1902, with 1891 as base; 1902-1913, with 1902 as base; and 1913-1926, with 1913 as base. In addition, the prices of a number of commodities during the years 1903-1926 have been reduced to relatives on the 1891 base. In dealing with link relatives, prices in all years from 1890 to 1926 have been employed.

Complete descriptive measures relating to the following distributions of price relatives appear in Appendix Tables XIX to XXVII:

Fixed base relatives, natural form, unweighted and weighted, by periods, 1892-1926

Fixed base relatives natural form, unweighted, 1903-1926 (A special study of 195 price series, reduced to relatives on the 1891 base. Measures for this group for the years 1892-1902 are included under the preceding item.)

Fixed base relatives, logarithmic form, unweighted and weighted, 1914-1926

Link relatives, natural form, unweighted and weighted, 1914-1926

Link relatives, logarithmic form, unweighted and weighted, 1891-1926

Measures of central tendency, dispersion, skewness and kurtosis, and the Pearsonian criteria of curve type have been computed for the above distributions.[1] In addition, measures of central tendency and dispersion have been computed for fixed base relatives in logarithmic form, unweighted and weighted, from 1892 to 1913, and for link relatives in natural form, unweighted and weighted, from 1891 to 1913. For the measurement of changes in the price level and for the study of internal instability we thus have eight sets of measures for the years 1891 to 1926 (the initial year is 1892, in the case of fixed base relatives). The number of price relatives employed was 195 for the years prior to 1902, 205 for the years from 1902 to 1913, and from 385 to 391 for the years from 1914 to 1926. The commodities included are described in detail in Appendix Table I.

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[1] The construction of logarithmic frequency distributions and the computation of the corresponding logarithmic measures would be a very laborious procedure if the logarithms of the individual price relatives had to be looked up before the measures were tabulated. This may be avoided, and all the ease of computation possible with frequency distributions of the arithmetic type may be secured, by constructing a tabulation form in which the class-limits are stated in natural numbers, but in which the class-interval is constant on a logarithmic scale. For example, if it is decided, upon inspection, that a logarithmic class-interval of .03 would be appropriate for the classification of the logarithms of a given set of relative prices, a form may be prepared upon which the class-limits in logarithmic form appear in the first column. In the second column may be written the natural numbers corresponding to the logarithmic class-limits. The actual tabulation may now be carried out, using the price relatives in their natural form. In the calculations of means and standard deviations, and of the higher moments, the class-interval unit may be used throughout in the customary fashion.

This method is of considerable practical importance, for by its employment geometric means and all corresponding logarithmic measures may be computed as readily as the arithmetic measures. Such logarithmic measures of central tendency and dispersion are possibly of wider general utility than the arithmetic measures usually employed.

2. WEIGHTS

The weights which have been employed in the present study are based upon the estimated values of the various commodities entering into trade during the period 1920-23, as given in the wholesale price bulletins of the United States Bureau of Labor Statistics. In certain cases the weight of a given commodity has been altered somewhat for the different years covered, in order that the group in which it falls might be adequately represented. For example, raw cotton is represented by two quotations during the years since 1913 and by but one quotation during the years preceding. The one continuing quotation is given heavier weight during the early than in the later period.

It is recognized that weights based upon post-war values in exchange are likely to be somewhat in error, if applied to price quotations extending back to 1890. Accordingly, the weights employed in the present study are to be looked upon only as approximations to ideally perfect weights. No attempt has been made to secure perfect accuracy for each period in the matter of weighting. This would not have been possible, in any case, nor was it considered necessary for the purposes in mind. It has been well established that refinements of precision in weighting are not necessary to the accuracy of price index numbers.

The weight given to each commodity in each period is shown in Table I in the Appendix.[1] The percentage distributions of these weights among the different groups represented in the Bureau of

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[1] Only the commodities for which weights are given in Table I have been used in the study of frequency distributions of price relatives. The other commodities listed in this table have been employed in other parts of the present investigation, in which the problem of weighting did not arise.

Weights are applied in all cases directly to the price relatives. Thus if a commodity has a weight of 10, its price relative in a given year is handled as though it occurred 10 times.

Labor Statistics and Federal Reserve Board classifications[1] appear in the following tables. For purposes of comparison the percentage distributions of the weights used by the Bureau of Labor Statistics in 1909, 1919 and 1924, and by the Federal Reserve Board in 1913 and 1923, are also shown.

TABLE 85

Percentage Distributions of Weights among Commodity Groups
United States Bureau of Labor Statistics Classification

(1) Commodity group	(2)	(3)	(4)	(5)	(6)	(7)
	Percentage of total weight Present study			Percentage of total weight U. S. B. of L. S. index*		
	1890–1902	1902–1913	1913–1926	1909	1919	1924
Farm products	31.7	31.0	27.1	27.6	28.1	28.5
Foods	22.9	22.4	23.0	26.3	24.5	23.0
Cloths and clothing	11.6	11.7	10.4	11.2	14.3	9.8
Fuel and lighting	13.7	13.4	12.8	10.3	8.7	13.6
Metals and metal products	5.5	6.5	8.5	5.7	6.2	8.4
Building materials	5.4	5.9	5.7	11.5	9.7	5.4
Chemicals and drugs	1.2	1.2	2.0	1.3	1.1	1.8
House-furnishings	1.8	1.8	3.2	0.4	0.5	3.3
Miscellaneous	6.2	6.1	7.3	5.7	6.9	6.2
All commodities	100.0	100.0	100.0	100.0	100.0	100.0

*Certain of the differences between years in the percentage distributions of weights among the groups in the Bureau of Labor Statistics index are due to changes in the constituent items. This is particularly true of building materials and house-furnishings.

TABLE 86

Percentage Distributions of Weights among Commodity Groups
Federal Reserve Board Classification

(1) Commodity group	(2)	(3)	(4)	(5)	(6)
	Percentage of total weight Present study			Percentage of total weight Federal Reserve Board classification of U. S. B. of L. S. data	
	1890–1902	1902–1913	1913–1926	1913	June 1923
Crops	13.8	13.5	12.6	12	12
Animal products	14.2	13.9	11.5	15	12
Forest products	3.8	3.7	3.4	3	4
Mineral products	14.7	14.3	13.0	11	16
Total raw materials	46.5	45.4	40.5	41	44
Producers' goods	12.9	14.5	19.4	21	18
Consumers' goods	40.6	40.1	40.1	38	38
All commodities	100.0	100.0	100.0	100	100

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[1] The classification of the Bureau of Labor Statistics is that employed by that Bureau prior to the recent revision of its index number of wholesale prices.

The relative importance of the different classes when no weights are used is indicated in the following tables, showing the distribution, among the various groups, of the commodities employed in the present study.

TABLE 87

Distributions of Commodities, by Groups

United States Bureau of Labor Statistics Classification

(1) Commodity group	(2)	(3)	(4)	(5)	(6)	(7)
	1890-1902		1902-1913		1913-1926	
	No. of commodities	Per cent	No. of commodities	Per cent	No. of commodities	Per cent
Farm products	24	12.3	24	11.7	55	14.1
Foods	36	18.5	37	18.1	92	23.5
Cloths and clothing	38	19.5	44	21.5	65	16.6
Fuel and lighting	12	6.1	12	5.9	15	3.8
Metals and metal products	19	9.7	21	10.2	37	9.5
Building materials	21	10.8	22	10.7	32	8.2
Chemicals and drugs	11	5.6	11	5.4	39	10.0
House-furnishings	21	10.8	21	10.2	31	7.9
Miscellaneous	13	6.7	13	6.3	25	6.4
All commodities	195	100.0	205	100.0	391	100.0

TABLE 88

Distributions of Commodities, by Groups

Federal Reserve Board Classification

(1) Commodity group	(2)	(3)	(4)	(5)	(6)	(7)
	1890-1902		1902-1913		1913-1926	
	No. of commodities	Per cent	No. of commodities	Per cent	No. of commodities	Per cent
Crops	9	4.6	9	4.4	21	5.4
Animal products	11	5.7	11	5.4	21	5.4
Forest products	7	3.6	7	3.4	11	2.8
Mineral products	17	8.7	17	8.3	30	7.6
Total raw materials	44	22.6	44	21.5	83	21.2
Producers' goods	51	26.1	54	26.3	112	28.7
Consumers' goods	100	51.3	107	52.2	196	50.1
All commodities	195	100.0	205	100.0	391	100.0

3. Significance of Frequency Distributions of Price Relatives

A bird's-eye view of price changes between 1913 and 1926 is afforded by the graphs of distributions of price relatives which are plotted in Figure 21. These graphs afford, also, a means of com-

FIGURE 21

Column Diagrams Showing Frequency Distributions of Price Relatives[1]
(1914-1920)

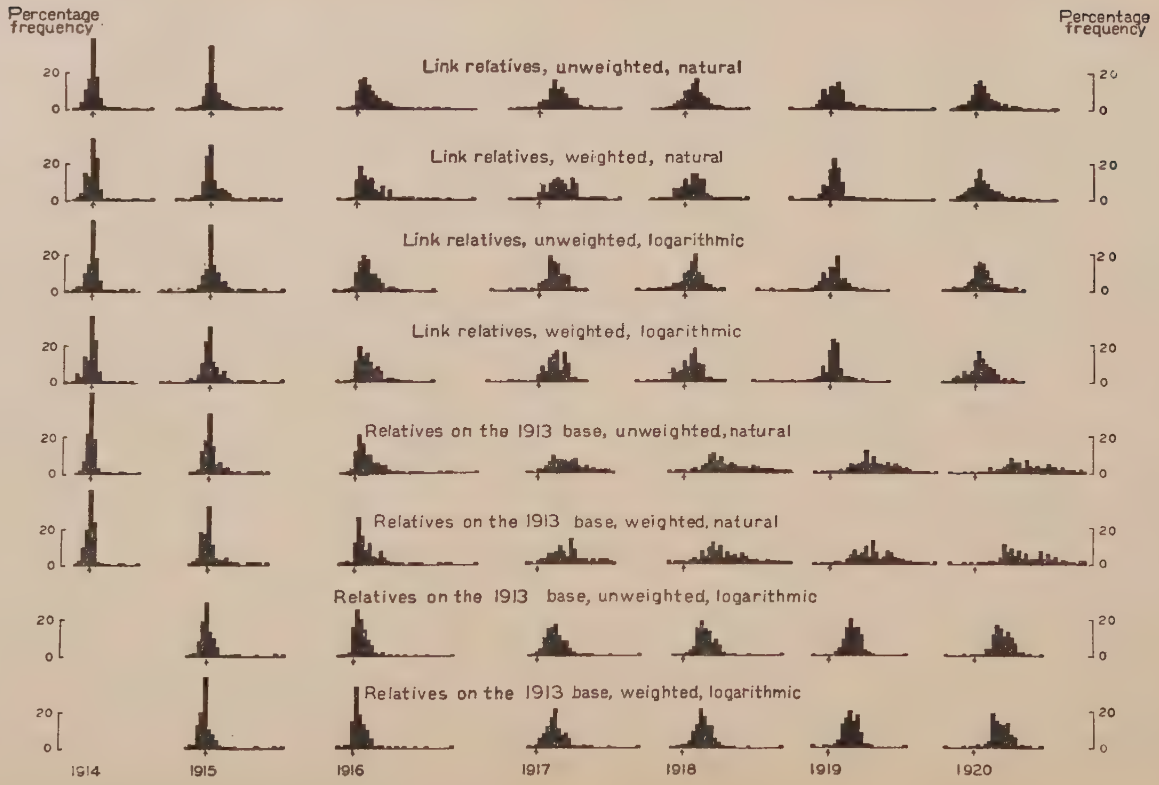
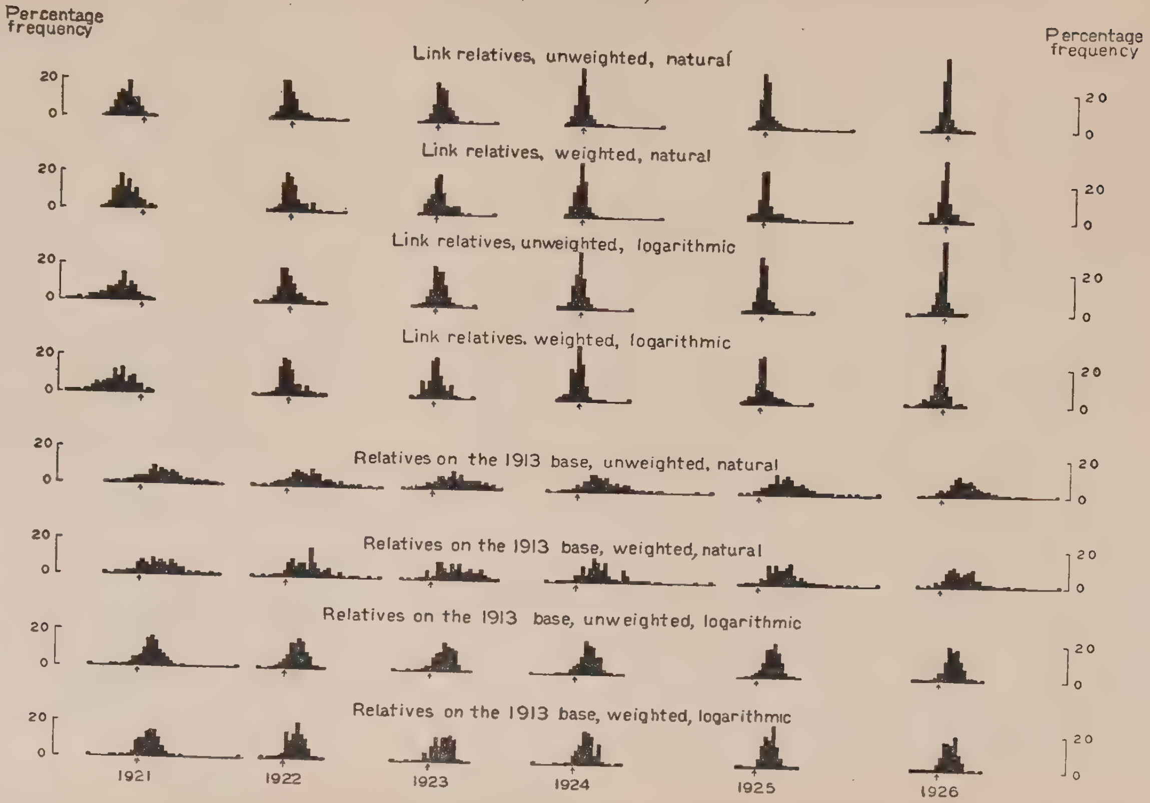


FIGURE 21 (Cont.)

COLUMN DIAGRAMS SHOWING FREQUENCY DISTRIBUTIONS OF PRICE RELATIVES[1]
(1921-1926)



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[1] The number of observations included in these distributions varies from 387 to 391.
Class intervals are the same for unweighted and weighted distributions. They are not the same for distributions of link and fixed base relatives. The slight differences between the link and fixed base distributions for the year 1914 are due to this fact.
The location of the 100 point on the x-scale (the 2.00 point when logarithms are employed) is indicated in each diagram by an arrow.

paring visually the distributions secured from fixed base and link relatives, from weighted and unweighted relatives, from relatives in natural and relatives in logarithmic form. Class frequencies have been expressed in percentage form throughout, so that direct comparison of all distributions is possible.

It is clear that these distributions possess features common to all collections of quantitative data relating to social and biological phenomena. From the host of individual price changes, which seem erratic and unrelated when viewed as separate entities, have been secured distributions with distinct and definite characteristics. The fact that something approaching a common type of distribution seems to prevail among the groups represented in these charts justifies the application of a common method in measuring their distinctive features. But more pronounced than any general resemblances are the differences between the distributions for different years and for different forms of the original data. It is these differences which are matters of interest.

The measures describing the distributions which are graphically portrayed in this chart, and those relating to distributions for earlier years, enable the nature and magnitude of these differences to be precisely determined. Having these measures it is possible to consider several questions which are of considerable importance in connection with the theory and practice of index number construction, and which have a direct bearing upon the problem of price stability. The following specific questions may be raised:

1. What economic significance attaches to changes in the four basic measures descriptive of frequency distributions of price relatives (i. e. the measures of central tendency, of dispersion, of skewness and kurtosis)? What light is cast by these measures upon the problems outlined above, relating to changes in the general price level and to the internal stability of the price system?
2. Are there significant differences between the different types of frequency distributions? Do distributions based upon unweighted price relatives differ materially from those based upon weighted relatives? Do logarithmic distributions differ materially from natural distributions? Do distributions composed of link relatives differ materially from those constructed from fixed base relatives? Which type of distribution appears to be most stable? Which type of distribution

gives the most reliable measures of central tendency and dispersion?

3. Is there any tendency for the distributions of price relatives to approach a standard type of distribution (e. g. the normal or Gaussian type)?
4. Is there any evidence of a change in type over the period of time covered in the present study? Are there significant changes in type with changing business conditions?
5. Does a study of these distributions afford evidence as to the stability or instability of distributions of price relatives? Does it afford evidence as to the homogeneity or heterogeneity of distributions of price relatives?

In attempting to answer these questions methods of describing frequency distributions in detail must be used. The measures utilized in the present study are those developed by Karl Pearson in connection with his comprehensive system of frequency curves. Such measures afford materials for comparing and classifying frequency distributions, and reveal the distinctive characteristics of individual distributions. Detailed accounts of the method followed in computing these measures are available in Pearson's original memoirs[1] and in various other sources. The measures secured from the application of these methods are given in Appendix Tables XIX-XXVII. They are considered in detail in the following sections of this chapter.

§Note on the Description of Frequency Distributions

The problems which called forth Pearson's measures arose from the failure of the normal curve of error to describe the actual distributions found in experience. Marked and persistent departures from this standard type were found in every scientific field. If one were not to assume that all such departures resulted from lack of homogeneity in the data, an assumption that seemed quite unjustified, it was necessary to recognize the existence of non-Gaussian types of distributions, and to develop methods of distinguishing these types from the normal form and of describing and graduating them. This is a problem which has been attacked in various ways. Pearson's solution is the one which has been worked out in greatest detail and is most widely employed.

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[1] "Skew Variation in Homogeneous Material," *Phil. Trans. of the Royal Society of London*, Vol. 186, A (1895), pp. 343-414; Supplement, Vol. 197, A (1901), pp. 443-459; Second Supplement, Vol. 216, A (1916), pp. 429-457.

"Das Fehlergesetz und seine Verallgemeinerungen durch Fechner und Pearson," A Rejoinder. *Biometrika*, Vol. IV (1905), pp. 169-212.

In a particular case the general problem reduces itself to two distinct questions:

1. Is the distribution in question significantly different from the normal type? In any concrete instance some difference from the normal is to be expected, as a result of chance fluctuations of sampling, hence a test of the significance of such differences is necessary.
2. If the distribution is significantly different from the Gaussian type, is it possible to place it in some standard classification and to employ a generalized method of graduation similar to that employed when a normal curve is fitted?

In respect to deviations from the normal type, Pearson set forth the following as the chief physical differences between actual frequency distributions and the Gaussian theoretical distribution:

1. The separation between the mode, or position of maximum frequency, and the average or mean character.
2. The ratio of this separation between mean and mode to the variability of the character, a quantity termed the *skewness.*
3. A degree of peakedness (or, viewed inversely, of flat-toppedness) which is greater or less than that of the normal curve. This attribute relates to the *kurtosis* of the curve.

Pearson developed measures for these characteristics (the modal divergence, the skewness and the kurtosis) each of which would be zero for the normal type. He determined, also, the probable errors of these measures, by means of which it is possible to determine whether a given value of any measure represents a significant departure from the Gaussian type. The first of the preceding questions may, therefore, be readily answered for a given distribution.

So far the results are purely negative, if the normal curve fails to fit the given distribution. The next step is the development of a technique for describing and graduating the non-Gaussian distributions which are met with so frequently in statistical practice. This Pearson has done. The process of evaluating the differences between an actual frequency distribution and the Gaussian theoretical type involves a knowledge of the dispersion, the skewness and the kurtosis of the given distribution. These same three measures in slightly different form furnish criteria which serve to define the curve type, whether it be Gaussian or non-Gaussian. The other specific attributes of the curve desired in a given case (its position on the x-scale and its size) are fixed by the value of the mode, or mean, and the total frequency.

The details of the methods employed in graduating these distributions do not concern us in the present study, but considerable interest attaches to the criteria of curve type and the information they yield.

Five such criteria have been computed for each of the price distributions listed above. These are

$$\beta_1 = \frac{\mu^2{}_3}{\mu^3{}_2}$$

$$\beta_2 = \frac{\mu_4}{\mu^2{}_2}$$

$$\kappa_1 = 2\beta_2 - 3\,\beta_1 - 6$$

$$\kappa_2 = \frac{\beta_1\,(\beta_2 + 3)^2}{4\,(4\beta_2 - 3\beta_1)\,(2\beta_2 - 3\,\beta_1 - 6)}$$

$$\mathrm{r} = \frac{6\,(\beta_2 - \beta_1 - 1)}{2\,\beta_2 - 3\,\beta_1 - 6}$$

where the letters μ_1, μ_2, μ_3 and μ_4 designate the first four moments about the mean, adjusted, where necessary, by the application of Sheppard's corrections.

Differences between Gaussian and non-Gaussian curves are defined by the following measures:

$$\eta \text{ (Kurtosis)} = \beta_2 - 3$$

$$\chi \text{ (Skewness)} = \frac{\sqrt{\beta_1}\,(\beta_2 + 3)}{2\,(5\,\beta_2 - 6\,\beta_1 - 9)}$$

$$d \text{ (Modal divergence)} = \chi.\sigma$$

III Changes in the Level of Wholesale Prices

The immediate purpose of the present investigation is not the measurement of changes in the level of prices, a subject which has been discussed extensively elsewhere. But in a study of the behavior of prices in combination some attention must be given to such general price changes, for these constitute one important aspect of group behavior.

1. Comparison of Index Numbers

The column diagrams which are shown in Figure 21 differ from year to year in many ways—in the location of the point of maximum concentration, in the degree of dispersion, in the direction and degree of skewness, and in peakedness. Our present concern is with the shifts in the central tendency from year to year, as measured by the changing values of the annual averages. Prices as a whole drift upward or downward, and the changing position on the x-scale of the point of maximum concentration is an indication of the direction and degree of this drift. It is possible to follow this drift on the charts by noting the varying distances between the central tendencies of the various distributions and the 100 point on the *x*-scals (the point with a value of 2.00 for the logarithmic distributions). The location of this point is indicated on each of the diagrame. Such inspection provides, of course, only a general impression of the degree of change in the level of prices between given dates. More accurate information concerning these movements is given by the averages of the various distributions, averages which constitute index numbers of the usual type.[1]

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[1] In the present study the averages were computed from grouped data. This was done because chief interest attached to measures, other than the mean, describing the various frequency distributions. That a very small error is involved in computing the mean from grouped data, instead of from individual price relatives, is clear from the following table. Measures derived in an earlier study from ungrouped data are here compared with results secured from grouped observations. The comparison is of interest because of its bearing upon practical problems of index number construction.

Weighted geometric means of link relatives computed from ungrouped data, each relative taken to the nearest whole number, are given in column (3) of this table. The weighted geometric means in column (4) were computed from frequency distributions of logarithms of link relatives, the logarithmic class-interval being .03. This is equivalent to a natural class-interval of 3 in the neighborhood of 50 and of 10 in the neighborhood of 150. The weights and the number of price quotations were the same in the two calculations. For purposes of comparison the year-to-year changes in prices recorded by the Bureau of Labor Statistics index of wholesale prices are shown in column (5). The numbers given in column (2) refer, it should be noted, only to the averages in columns (3) and (4).

INDEX NUMBERS OF WHOLESALE PRICES COMPUTED FROM UNGROUPED AND GROUPED LOGARITHMS OF PRICE RELATIVES, WITH INDEX OF UNITED STATES BUREAU OF LABOR STATISTICS

(1) Year	(2) No. of price quotations	(3) Weighted geometric mean of link relatives (computed from ungrouped data)	(4) Weighted geometric mean of link relatives (computed from grouped data)	(5) Link relative computed from U. S. Bureau of Labor Statistics wholesale price index
1891	195	100.0	100.0	99.3
1892	195	94.4	93.8	93.6
1893	195	101.7	101.8	102.4
1894	195	90.0	89.9	89.7
1895	195	101.3	101.3	101.9
1896	195	95.4	95.3	95.3
1897	195	100.7	100.6	100.1
1898	195	103.1	102.6	104.2
1899	195	107.3	107.1	107.6
1900	195	108.8	108.5	107.5
1901	195	99.2	99.2	98.5
1902	195	107.0	107.3	106.4
1903	205	101.1	100.8	101.3
1904	205	99.9	99.6	100.1
1905	205	100.3	100.6	100.7
1906	205	103.5	103.6	102.8
1907	205	106.1	106.4	105.5
1908	205	96.2	96.0	96.4
1909	205	106.3	106.1	107.5
1910	205	103.0	102.9	104.1
1911	205	94.6	94.5	92.8
1912	205	106.5	106.8	105.9
1913	205	100.9	101.1	100.9
1914	391	97.8	97.9	98.1
1915	391	101.1	101.1	102.8
1916	391	125.8	125.8	125.8
1917	391	138.5	138.6	139.7
1918	389	111.7	111.7	109.7
1919	389	107.1	106.8	106.2
1920	391	109.9	110.2	109.6
1921	391	65.3	65.4	64.9
1922	391	101.2	101.0	101.3
1923	390	104.7	105.0	103.3
1924	390	97.1	97.4	97.4
1925	387	105.6	105.8	106.0

(Footnote continued on next page.)

These index numbers are given in simple and chained form in the summary tables of measures relating to the different frequency distributions (Appendix Tables XIX-XXVII). To permit ready comparison of the results secured by different methods of combining price relatives these measures have been brought together in the following tables.[2] The index numbers in Tables 93 and 94 are plotted in Figures 22 and 23.

TABLE 89

Index Numbers Measuring Changes in the Level of Wholesale Prices in the United States, 1891-1902

Measures Computed from Fixed Base Relatives
(1891=100)

(1) Year	(2) Un-weighted arithmetic mean	(3) Weighted arith-metic mean	(4) Un-weighted median	(5) Weighted median	(6) Un-weighted geometric mean	(7) Weighted geometric mean	(8) U. S. B. of L. S. index
1891	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1892	95.4	95.1	95.9	94.3	94.5	93.8	93.5
1893	95.1	97.4	95.7	97.1	93.9	95.8	95.7
1894	85.7	87.3	87.2	88.3	84.3	85.7	85.9
1895	84.3	89.6	83.5	87.8	82.8	87.3	87.5
1896	81.5	85.1	81.9	84.1	79.6	82.8	83.4
1897	81.0	85.2	81.8	85.4	79.3	83.7	83.5
1898	84.9	88.1	83.9	88.7	83.0	86.4	87.0
1899	92.5	94.8	91.0	93.6	90.2	92.1	93.6
1900	100.1	102.9	99.1	102.4	97.3	100.1	100.6
1901	99.2	102.2	97.6	100.5	96.3	99.6	99.1
1902	102.8	109.7	98.7	104.2	99.6	106.0	105.5

(Continuation of footnote 1, p. 230.)

The greatest discrepancy between the geometric means computed from individual price relatives and those computed from the grouped data is .6, about 6-10 of one per cent of the average in question. This is a negligible difference, for it is less than the probable error of the average. This difference would, of course, tend to be greater with a smaller number of price quotations, but when as many as 200 commodity prices are utilized no material error may be expected from the employment of grouped observations, if appropriate class-intervals be employed.

These numerical results are in accord with general theory concerning errors due to grouping. The standard error due to grouping, for both mean and standard deviation, has been given as $\frac{1}{\sqrt{12N}}$ (in class-interval units). When the sample includes 200 observations and a logarithmic class-interval of .03 is employed, the standard error due to grouping is less than 2-10 of one per cent of the average.

There is one case in which it may be desirable to compute index numbers from individual observations, without grouping, even though the observations be numerous. This is when averages are to be computed from link relatives, these averages to be later chained over a term of years. The chaining involves the cumulation of errors, a process which may magnify a rather slight original error.

[2] The number of price quotations employed each year is shown in the general tables in the Appendix. The names of the different commodities included in the calculations for the different periods, and their weights, are given in Appendix Table I.

TABLE 90

INDEX NUMBERS MEASURING CHANGES IN THE LEVEL OF WHOLESALE PRICES IN THE UNITED STATES 1891-1902

Measures Computed from Link Relatives
(1891=100 for all chain indexes)

(1) Year	(2) Unweighted arithmetic mean	(3) Chain index constructed from unweighted arithmetic mean	(4) Weighted arithmetic mean	(5) Chain index constructed from weighted arithmetic mean	(6) Unweighted median	(7) Chain index constructed from unweighted median	(8) Weighted median	(9) Chain index constructed from weighted median	(10) Unweighted geometric mean	(11) Chain index constructed from unweighted geometric mean	(12) Weighted geometric mean	(13) Chain index constructed from weighted geometric mean
1891	100.3	100.0	101.4	100.0	99.2	100.0	100.7	100.0	99.3	100.0	100.0	100.0
1892	95.4	95.4	95.1	95.1	95.9	95.9	94.3	94.3	94.5	94.5	93.8	93.8
1893	100.1	95.5	102.3	97.3	98.8	94.7	101.1	95.3	99.5	94.0	101.8	95.5
1894	90.6	86.5	90.7	88.3	91.0	86.2	89.8	85.6	90.0	84.5	89.8	85.7
1895	99.1	85.7	102.7	90.7	97.8	84.3	101.0	86.5	98.1	82.9	101.3	86.9
1896	97.1	83.2	96.3	87.3	98.5	83.0	97.3	84.2	96.0	79.6	95.3	82.8
1897	100.9	83.9	101.6	88.7	99.9	82.9	100.8	84.9	99.8	79.4	100.6	83.2
1898	105.1	88.2	103.4	91.7	102.6	85.1	101.9	86.5	104.3	82.8	102.6	85.4
1899	109.8	96.8	108.2	99.2	105.3	89.6	105.9	91.6	108.5	89.9	107.1	91.5
1900	109.0	105.5	109.8	108.9	107.2	96.1	105.6	96.7	108.4	97.5	108.5	99.3
1901	99.7	105.2	100.2	109.1	98.7	94.9	99.4	96.1	98.8	96.4	99.2	98.5
1902	104.8	110.2	107.7	117.5	103.1	97.8	106.1	102.0	104.2	100.3	107.3	105.6

TABLE 91

Index Numbers Measuring Changes in the Level of Wholesale Prices in the United States, 1902-1913

Measures Computed from Fixed Base Relatives
(1902=100)

(1) Year	(2) Un-weighted arithmetic mean	(3) Weighted arith-metic mean	(4) Un-weighted median	(5) Weighted median	(6) Un-weighted geometric mean	(7) Weighted geometric mean	(8) U. S. B. of L. S. index
1902	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1903	101.3	102.3	101.6	102.4	100.2	100.8	101.3
1904	101.6	103.8	101.0	102.7	100.0	101.5	101.4
1905	103.0	103.7	102.9	104.9	101.4	102.7	102.1
1906	109.0	106.6	108.0	106.2	106.8	104.7	105.0
1907	115.1	113.5	114.6	113.8	112.8	111.6	110.8
1908	106.8	108.6	109.0	109.7	104.8	106.8	106.7
1909	109.9	116.3	112.3	113.6	107.6	113.9	114.8
1910	115.2	120.3	115.7	117.2	112.1	117.2	119.5
1911	113.1	113.3	110.8	111.0	109.1	110.7	110.2
1912	116.6	119.6	114.6	123.5	113.0	117.2	117.4
1913	116.7	120.9	116.3	123.1	113.5	118.4	118.5

It is not the purpose of the present inquiry to consider in detail the relative merits of different types of index numbers. This has been done in a comprehensive fashion in other investigations. The results in the accompanying tables, which are by-products of the general study, have been presented because of the interest they may possess to students of index numbers. Only a few comments are called for at this point.

The diversity of results is apparent, a diversity that indicates the inherent difficulty of describing by a single measure the complex price movements which take place between given dates. Certain of the averages differ materially from the bulk of the measures secured. One of the results, for which Irving Fisher's conclusions prepare us, is the upward "bias" of the weighted index numbers during the first two periods. We may compare the unweighted and weighted fixed base index numbers (including the chain indexes, but excluding the index of the Bureau of Labor Statistics) at the end of each of the three periods (i. e. in 1902, 1913 and 1926). In each of six comparisons for the year 1902 the weighted index number exceeds the corresponding unweighted measure. The same thing is true of the averages for 1913. At the end of the third period the unweighted measures exceed the corresponding weighted measures in all cases. This upward tendency of the weighted numbers during

TABLE 92

Index Numbers Measuring Changes in the Level of Wholesale Prices in the United States, 1902-1913

Measures Computed from Link Relatives
(1902=100 for all chain indexes)

(1) Year	(2) Un-weighted arithmetic mean	(3) Chain index constructed from unweighted arithmetic mean	(4) Weighted arithmetic mean	(5) Chain index constructed from weighted arithmetic mean	(6) Un-weighted median	(7) Chain index constructed from unweighted median	(8) Weighted median	(9) Chain index constructed from weighted median	(10) Un-weighted geometric mean	(11) Chain index constructed from unweighted geometric mean	(12) Weighted geometric mean	(13) Chain index constructed from weighted geometric mean
1902	104.8	100.0	107.7	100.0	103.1	100.0	106.1	100.0	104.2	100.0	107.3	100.0
1903	101.3	101.3	102.3	102.3	101.6	101.6	102.4	102.4	100.2	100.2	100.8	100.8
1904	100.0	101.3	101.0	103.3	99.9	101.5	101.0	103.4	99.2	99.4	99.6	100.4
1905	102.3	103.6	100.8	104.1	101.4	102.9	100.8	104.2	101.9	101.3	100.6	101.0
1906	105.9	109.7	104.1	108.4	105.5	108.6	103.4	107.7	105.4	106.8	103.6	104.6
1907	105.8	116.1	106.5	115.4	104.5	113.5	106.1	114.3	105.5	112.7	106.4	111.3
1908	93.7	108.8	96.5	111.4	94.9	107.7	97.8	111.8	93.0	104.8	96.0	106.8
1909	103.1	112.2	106.5	118.6	101.3	109.1	103.9	116.2	102.6	107.5	106.1	113.3
1910	104.6	117.4	103.8	123.1	102.0	111.3	101.7	118.2	103.9	111.7	102.9	116.6
1911	98.8	116.0	95.4	117.4	98.1	109.2	95.4	112.8	97.7	109.1	94.5	110.2
1912	104.4	121.1	107.4	126.1	102.9	112.4	106.6	120.2	103.8	113.2	106.8	117.7
1913	100.9	122.2	101.9	128.5	101.0	113.5	101.0	121.4	100.1	113.3	101.1	119.0

TABLE 93

INDEX NUMBERS MEASURING CHANGES IN THE LEVEL OF WHOLESALE PRICES IN THE UNITED STATES, 1913-1926

Measures Computed from Fixed Base Relatives
(1913=100)

(1) Year	(2) Un-weighted arithmetic mean	(3) Weighted arith-metic mean	(4) Un-weighted median	(5) Weighted median	(6) Un-weighted geometric mean	(7) Weighted geometric mean	(8) U. S. B. of L. S. index
1913	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1914	100.0	98.3	99.6	99.3	99.2	97.9	98.1
1915	110.1	100.6	100.4	97.9	104.0	98.6	100.8
1916	142.5	127.8	121.0	118.2	130.3	124.6	126.8
1917	190.5	180.1	171.2	174.6	176.3	172.2	177.2
1918	214.7	198.5	192.3	187.7	202.1	192.2	194.3
1919	218.4	211.8	208.9	207.9	210.7	205.2	206.4
1920	245.3	236.7	229.3	223.2	233.0	225.3	226.2
1921	160.2	155.0	154.7	151.9	151.6	146.6	146.9
1922	154.5	155.0	151.5	156.0	147.7	147.8	148.8
1923	164.8	162.8	159.9	160.3	158.1	155.8	153.7
1924	162.8	157.9	156.3	152.5	155.4	152.3	149.7
1925	167.7	164.1	165.1	162.5	161.3	159.4	158.7
1926	161.1	156.4	156.0	152.1	154.7	150.7	151.0

the first and second periods is an inherent characteristic of "given year" weighting (i. e. the use of weights based upon values at the second of two dates for which prices are compared). In the present study weights based upon post-war values are employed. This is not "given year" weighting, but the effect upon the index numbers during the two earlier periods is the same. Those commodities with a pronounced upward trend in price were heavily weighted, relatively, while those for which the trend was downward, or upward at a low rate, were less heavily weighted.

The differences between weighted and unweighted results are perhaps more clearly brought out by a year-to-year comparison of corresponding weighted and unweighted averages. If we include medians and arithmetic and geometric means of fixed base relatives, and chain indexes constructed from medians and arithmetic and geometric means of link relatives, we have 126 pairs of indexes (weighted and unweighted) measuring price changes during the two periods between 1892 and 1913, and 75 pairs covering the years 1914 to 1926. (The base years are 1891, 1902 and 1913. Duplicate measures for the first year after the base year have been omitted in these comparisons.) In 110 out of the 126 comparisons during the

TABLE 94

Index Numbers Measuring Changes in the Level of Wholesale Prices in the United States 1913-1926

Measures Computed from Link Relatives
(1913=100 for all chain indexes)

(1) Year	(2) Un-weighted arithmetic mean	(3) Chain index constructed from unweighted arithmetic mean	(4) Weighted arithmetic mean	(5) Chain index constructed from weighted arithmetic mean	(6) Un-weighted median	(7) Chain index constructed from unweighted median	(8) Weighted median	(9) Chain index constructed from weighted median	(10) Un-weighted geometric mean	(11) Chain index constructed from unweighted geometric mean	(12) Weighted geometric mean	(13) Chain index constructed from weighted geometric mean
1913	100.9	100.0	101.9	100.0	101.0	100.0	101.0	100.0	100.1	100.0	101.1	100.0
1914	100.0	100.0	98.3	98.3	99.6	99.6	99.3	99.3	99.2	99.2	97.9	97.9
1915	108.7	108.7	102.4	100.6	101.5	101.2	99.2	98.5	105.4	104.5	101.1	98.9
1916	127.6	138.7	128.4	129.2	119.8	121.2	120.4	118.6	124.7	130.2	125.8	124.5
1917	138.0	191.4	140.9	182.1	135.0	163.6	138.9	164.8	135.4	176.3	138.6	172.6
1918	117.0	224.0	113.7	207.0	116.8	191.1	114.9	189.4	114.8	202.5	111.7	192.8
1919	107.3	240.3	108.5	224.7	106.5	203.5	107.3	203.2	104.2	211.0	106.8	205.9
1920	114.1	274.2	113.1	254.1	109.9	223.6	109.2	221.8	111.0	234.3	110.2	226.9
1921	67.4	184.9	67.5	171.5	67.9	151.8	65.9	146.1	65.2	152.8	65.4	148.4
1922	99.2	183.4	102.6	175.9	94.9	144.1	98.5	144.0	97.5	149.0	101.0	149.9
1923	107.9	197.9	106.2	186.9	106.8	153.9	104.9	151.0	107.0	159.4	105.0	157.4
1924	99.5	196.9	98.2	183.5	98.9	152.1	98.0	148.0	98.5	157.0	97.4	153.3
1925	105.2	207.1	107.3	197.0	102.7	156.2	104.1	154.1	104.3	163.8	105.8	162.3
1926	96.4	199.6	95.4	187.9	97.1	151.7	97.0	149.2	95.7	156.8	94.5	153.4

INDEX NUMBERS OF WHOLESALE PRICES, 1913-1926.
United States Bureau of Labor Statistics Index Number and Six Index Numbers Computed from Fixed Base Relatives.
(1913 = 100)

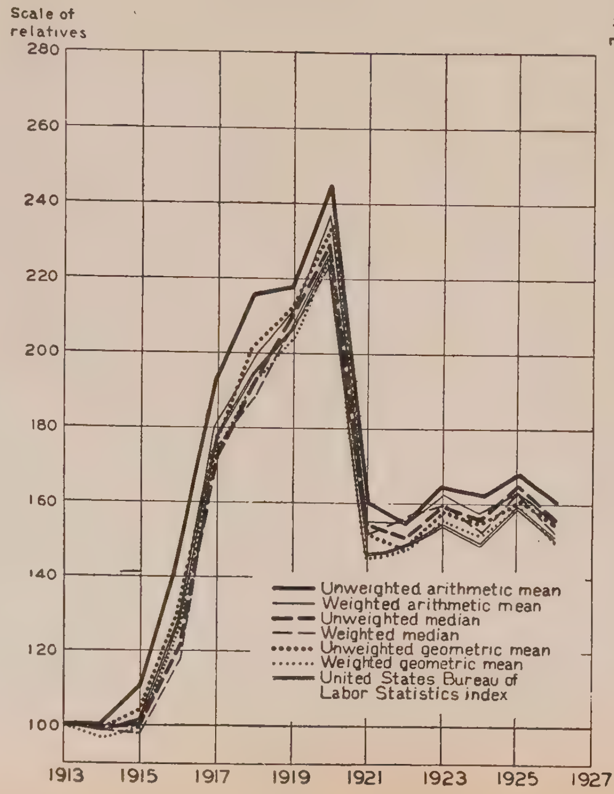
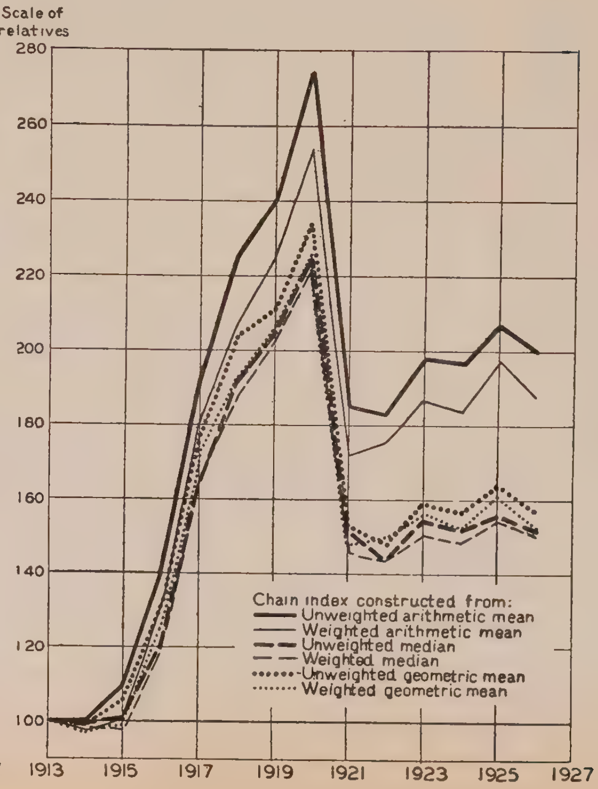


FIGURE 23

INDEX NUMBERS OF WHOLESALE PRICES, 1913-1926.
Six Index Numbers Constructed by Chaining Averages of Link Relatives.
(1913 = 100)



years between 1892 and 1913 the weighted indexes are larger than the corresponding unweighted measures. (The comparison in each case is between measures differing only in respect to weight.) During the period 1914-1926 the weighted indexes were greater in only 7 out of 75 cases.

§Price Trends and Bias in Index Numbers

It is clear, from some of the results presented in the first chapter, that over a period of years the prices of different commodities differ materially in their long-term trends. This fact, taken in conjunction with Professor Fisher's arguments concerning the effects of base year and given year weighting, has a distinct bearing upon the choice of weights in the construction of index numbers. If weights are based upon values (i. e. prices times quantities) at the end of a period, there will be an upward tendency not only in the index number for the single "given year" from which the weights were selected, but for every year during which the trends in question continued, unless the differences in price trends are counter-balanced by differences in quantity trends. Thus, if weights based upon values in 1913 were used in constructing index numbers for the period 1896-1913, the weights would cause an upward tendency in the index for every year in the period (assuming no changes in quantities). For, as we have seen, the period 1896-1913 was marked by fairly consistent trends in individual commodity prices, and these trends differed materially from article to article and from group to group. The 1913 weighting would over-value (relatively) the commodities having upward trends in price, and this over-valuing would tend to affect every year in the period. Conversely, weighting based upon values at the beginning of a period will give a downward "bias" to the index throughout the period (again on the assumption that this tendency is not offset by quantity changes). Since such differences in trends may be assumed to exist over any considerable period of years, weights based upon values at any fixed date will lead to bias. (The term *bias* is used in the sense in which it is employed by Irving Fisher in *The Making of Index Numbers*.) This will be upward for index numbers relating to years prior to the date to which the weights relate, and downward for all subsequent years. Cyclical and accidental movements which affect prices prevailing at a single date may possibly conceal the effects of this bias on the index number for that date, but unless quantity changes offset the changes due to differing price trends the long-run tendency would be as indicated.

The conclusion from this accords with that reached by Fisher, that weights should be based upon both base year and given year values. As applied to the measurement of price changes over a period of years, weights should presumably be averages of values at the beginning and end of the period, unless weights are changed from year to year. To employ as weights values prevailing at any single date is to introduce a persistent bias which will distort comparisons both backward and forward in time. The degree of distortion depends upon the degree of difference between the trends of the commodity prices employed and upon the degree of difference in quantity trends. These differences, for the period 1896-1913, doubtless account for the consistently higher values of the weighted measures. It is probable that similar differences in trends will develop during the period of relative stability which began in 1922.

In view of this fact, the practice of basing weights upon the most recent quantity and value figures available provides no solution of the weighting problem, if comparison over a number of years be sought. Comparison of recent years are presumably more accurate, of course, if recent weights be employed.

We may note in the above tables the close agreement between the Bureau of Labor Statistics index number and weighted geometric means of price relatives. In making this comparison it should be remembered that the constituent commodities are the same, with minor exceptions, and that the weights employed in the weighted index numbers constructed in the present study do not differ materially from those employed in constructing the index of the Bureau of Labor Statistics.

The most erratic of the index numbers are the chained arithmetic means of link relatives during the third period. Both weighted and unweighted measures of this type show excessively high values during the years following 1916. In contrast, the chained medians give results for the third period very close to those given by the Bureau of Labor Statistics index and the weighted geometric means.[1]

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[1] The various results presented above and in the Appendix make it possible to test a statement made by Edgeworth (Second Memorandum on *Variations in the Value of Money*; reprinted in *Papers Relating to Political Economy*, Vol. I, p. 330) that "the Median seems to keep closer to the Geometric (mean) than to the Arithmetic (mean)." If this were so it would accord with the suggestion made by Edgeworth and endorsed by other economists that price relatives tend to group themselves according to a logarithmic normal law, a subject which will receive some attention in a later section of this volume. In all, we have 136 distributions in which the location of geometric means, arithmetic means and medians may be compared. In 57 of these distributions the median is closer to the arithmetic average, in 79 closer to the geometric. (In making this comparison, the original averages of link relatives, before chaining, have been employed.) This accords with Edgeworth's statement, though it is clear that the relationship is not an invariable one. It does not appear to prevail in the distributions of fixed base relatives, for the median was closer to the arithmetic than to the geometric mean in 38 out of 70 such distributions. In 48 out of 72 distributions of link relatives the median was closer to the geometric than to the arithmetic mean. (Six duplicated distributions have been omitted in arriving at the total of 136, given above.)

A somewhat similar point, dealing with the relations between the arithmetic and geometric means and the mode, has been made by Wesley C. Mitchell. Dr. Mitchell gives as one of the advantages of geometric means that "they are likely to be nearer the modes of the distributions they represent than are arithmetic means." (*The Making and Using of Index Numbers*, Bulletin 284, U. S. Bureau of Labor Statistics, p. 71.) The results now in hand permit this statement to be tested. Using the computed modes

The true story of wholesale price changes from year to year during the period from 1890 to 1926 is told by the frequency distributions to which these various index numbers relate and in terms of which they must be interpreted. The averages which describe the central tendencies of these distributions provide a condensed account of one phase of the price changes which interest us.

The reason for the changes in the price level which are reflected in the shifts in these central tendencies has been a subject of some controversy, but it is not a matter which concerns us at present. We may assume it to be due to a single force or combination of forces. All prices are subject to the action of this force, but all are not equally affected by it. Some prices are rendered relatively inert by contract or custom, while others are peculiarly sensitive to the action of a general price-raising or price-lowering force. It is the failure of prices to change in the same proportion, and the presence of many specific price-making factors affecting individual commodities, that generate the problems of internal instability which are discussed below.

Our immediate problem, the measurement of changes in the general level of prices, is affected by these individual variations. Because of the differences between individual price changes, measures of central tendency are subject to some degree of error when computed from a sample and assumed to apply to the general population of prices. The size of this sampling error is a consideration of some importance in the selection of an index number, for the reliability of a given index number depends in part upon the magnitude of this error.

§ Reliability of Index Numbers[1]

It has been possible, from the results of the present inquiry, to estimate the standard errors of most of the index numbers represented

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in this comparison, we find practical equality between the results for the pre-war years for both fixed base and link relatives, but during the period 1914-1926 the geometric mean is closer to the mode than is the arithmetic mean in five-sixths of the distributions studied. During periods of rapid price rise there appears to be a pronounced tendency of the type suggested by Dr. Mitchell, but no such tendency is apparent at other times.

[1] There has been some debate concerning the application of the calculus of probabilities in the analysis of prices in combination, particularly in reference to the interpretation of index numbers. Recent opinions on this subject are summarized in "The Element of Probability in Index Numbers," by F. Y. Edgeworth (*Journal of the Royal Statistical Society*, Vol. 88, 1925, pp. 557-575). Professor Edgeworth points out that the role of probabilities in the construction of index numbers of prices is implicitly recognized when it is admitted, as all authorities admit, that sampling plays a part in the determination of such index numbers.

above. This has been done, for unweighted arithmetic and logarithmic (geometric) means, by the application of the usual formula:

$$\sigma_M = \frac{\sigma}{\sqrt{N}}$$

It has been recognized in applying this formula that the results secured are only approximations to the measures desired, but the approximation is sufficiently accurate for the purpose in mind, which is the comparison of measures relating to different index numbers computed from the same data. The use of this formula involves, of course, the assumptions that a random sample has been chosen, that the original observations are uncorrelated, and that the number of observations is sufficiently large to justify the use of the observed standard deviation in place of the standard deviation of the entire population. None of these conditions is fully satisfied in dealing with commodity prices. Reference is made below to the question of intercorrelation. In comparing different measures computed from the same original observations it may be ignored.

The standard errors of the weighted means are affected by the weights employed. Bowley has derived the following formula for the computation of such errors:

$$\sigma_{WM} = \frac{\sigma}{\sqrt{N}} \sqrt{1 + \frac{\sigma^2_W}{\bar{w}^2}}$$

(where σ_W represents the standard deviation and $\bar{w}$ represents the mean of the weights). As Professor Bowley points out, this formula must be applied with some reservations, but it probably provides reasonable estimates of the errors involved.[1]

The geometric means have all been computed from frequency distributions of logarithms of price relatives. Their standard errors, which were originally computed in logarithmic terms, have been expressed in natural form as percentages of the corresponding geometric means. To secure comparability the standard errors of arithmetic means have also been expressed as percentages of the averages to which they relate. All these measures of reliability have been summarized in the following table.

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[1] Bowley has dealt with this subject in *Elements of Statistics* (4th edition) pp. 316-326, and in "The Measurement of the Accuracy of an Average," *Journal of the Royal Statistical Society*, Vol. 75 (1911) pp. 77-88.

This formula is applied for the purpose of securing approximate measures of the sampling errors to which the various weighted averages are subject. It may be used, says Bowley, when the weights are known and are not subject to error. This condition is not entirely fulfilled in the present instance. The abnormal distribution and wide variation of the weights furnish additional reasons for not accepting the measures of error given by this formula as numerically accurate. These measures may, however, be accepted as estimates sufficiently accurate for the comparisons here to be made.

TABLE 95

MEASURES INDICATING THE SAMPLING RELIABILITY OF VARIOUS INDEX NUMBERS, BY YEARS[1]

(Standard errors of arithmetic and geometric means, expressed as percentages of the corresponding averages.)

(1) Year	(2) No. of price series	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Fixed base relatives				Link relatives			
		Unweighted		Weighted		Unweighted		Weighted	
		arithmetic	geometric	arithmetic	geometric	arithmetic	geometric	arithmetic	geometric
1891	195					.94	.94	1.83	2.02
1892	195	.77	.81	1.38	1.39	.77	.81	1.38	1.39
1893	195	1.16	1.13	2.44	2.34	.92	.88	1.65	1.58
1894	195	1.21	1.32	2.41	2.56	.80	.83	1.50	1.52
1895	195	1.36	1.35	3.23	2.80	.98	.96	2.02	1.87
1896	195	1.49	1.63	3.07	3.06	.94	1.03	1.71	1.87
1897	195	1.39	1.54	2.21	2.50	1.14	1.10	1.80	1.86
1898	195	1.50	1.53	2.44	2.57	.86	.83	1.39	1.48
1899	195	1.61	1.67	3.23	3.11	1.26	1.10	2.27	2.01
1900	195	1.67	1.76	3.07	3.06	.89	.87	1.79	1.61
1901	195	1.75	1.78	2.96	2.99	.93	.90	1.48	1.52
1902	195	1.78	1.82	3.45	3.40	.89	.93	1.61	1.64
1903	205	.78	.84	1.71	1.81	.78	.84	1.71	1.81
1904	205	1.20	1.24	2.61	2.66	.85	.89	1.83	1.92
1905	205	1.30	1.30	2.50	2.54	.67	.70	1.32	1.37
1906	205	1.43	1.39	2.36	2.37	.75	.75	1.47	1.44
1907	205	1.46	1.42	2.28	2.96	.73	.76	1.00	1.06
1908	205	1.32	1.42	2.25	2.41	.92	.95	1.54	1.62
1909	205	1.40	1.46	2.54	2.61	.77	.74	1.45	1.42
1910	205	1.77	1.63	2.97	2.91	.78	.76	1.53	1.48
1911	205	2.11	1.82	2.75	2.76	1.02	.97	1.70	1.63
1912	205	2.01	1.72	2.52	2.60	.74	.77	1.36	1.36
1913	205	1.71	1.63	2.59	2.65	.79	.83	1.63	1.57
1914	391	.66	.61	.92	.96	.66	.61	.92	.96
1915	391	3.26	1.34	2.82	1.65	1.94	1.13	1.82	1.38
1916	391	4.66	1.66	2.95	1.91	1.27	1.03	2.12	1.79
1917	391	3.59	1.77	2.99	2.64	.98	1.03	1.60	1.61
1918	389	2.82	1.64	2.50	2.38	1.00	1.04	1.77	1.86
1919	391[2]	1.64	1.38	2.14	2.25	1.23	1.24	1.56	1.55
1920	391	1.68	1.66	2.64	2.84	1.24	1.18	2.10	2.05
1921	391	1.65	1.75	2.76	3.08	1.30	1.37	2.35	2.40
1922	391	1.46	1.56	2.40	2.74	.99	.93	1.67	1.54
1923	390	1.48	1.59	2.45	2.82	.73	.72	1.44	1.44
1924	390	1.52	1.58	2.42	2.74	.73	.66	1.08	1.08
1925	387	1.36	1.41	2.12	2.13	.78	.68	1.82	1.50
1926	385	1.44	1.48	2.35	2.41	.57	.58	1.11	1.17

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[1] The bases of the fixed base relatives in the three periods are average prices in 1891, in 1902, and in 1913.

[2] 389 link relatives were employed.

In comparing these results for the different classes of index numbers, an essential difference between the weighted and the unweighted measures should be borne in mind. The standard errors of the weighted means tend, in general, to be larger than the standard errors of the unweighted means. The difference between the errors of weighted and unweighted means is likely to be material when the dispersion of the weights is great, as it is in the present case. While a recognition of this difference is important in comparing the weighted and unweighted index numbers, the fact that the error of the weighted index is greater in a given case does not necessarily mean that the unweighted measure is preferable. The ultimate standard for the weighted mean, the standard in terms of which sampling fluctuations are judged, is the *weighted* mean of the entire population from which the sample is drawn. The ultimate standard for the unweighted mean is the *unweighted* average of the entire population. If the former standard is the one we wish to approach, the weighted average of a sample may do it better than the unweighted, though the standard error of the weighted mean be greater than that of the unweighted. This same point holds in respect to the other averages compared. The question as to which average we would use if we were computing it from the entire population of price relatives is thus not answered by a comparison of standard errors. Sampling stability is, however, one important criterion of excellence in an index number, and measures of sampling reliability possess considerable practical and theoretical importance.

The figures in Table 95 may be used in comparing, in respect to sampling stability, unweighted and weighted averages, averages computed from fixed base and link relatives, and averages computed from relatives in logarithmic and in natural form.

The preceding discussion touched upon the first of these comparisons. We should expect the unweighted average to be less subject to sampling fluctuations than the weighted, and this is borne out by the results. When 136 different pairs of index numbers, each pair differing only in the matter of weighting, are compared, the unweighted average is found to have the smaller standard error in 131 cases. The only exceptions are arithmetic averages of link relatives for the year 1915, and arithmetic averages of fixed base relatives for the years 1915-1918. In these years the weighted average, in spite of its being subject to special sampling errors because of the use of widely dispersed weights, was liable to smaller sampling fluctuations than the unweighted. In years of exceptional price movements the simple arithmetic average of price relatives is particularly subject to sampling errors, because of the very wide dispersion of the unweighted relatives.

As we should expect, averages of link relatives are marked by smaller sampling errors than are averages of fixed base relatives. This is true in all of the 128 cases in which direct comparison is possible. This merely confirms the well-established principle that measures of year-to-year price changes are more accurate than measures of price changes between more widely removed dates.

The comparison of logarithmic and natural measures, after they have been reduced to comparable terms, gives a net result slightly in favor of the arithmetic figures. It is possible to make 136 direct comparisons between measures of reliability for averages which differ only in the form of the relative employed in their computation (i. e. logarithmic or natural). In 72 cases the standard error of the arithmetic measure is less than that of the logarithmic measure, in 58 cases the logarithmic mean is the more reliable, while in 6 cases the two are equal. This enumeration takes no account of the magnitude of the differences between the measures of reliability. If this be done, the odds swing somewhat in favor of the logarithmic measures, even though they be slightly behind on the above count. In years of extreme price disturbance the arithmetic measures are subject to wide sampling fluctuations, while the logarithmic measures are much more stable. In 1916 the standard error of the unweighted arithmetic mean of fixed base relatives was equal to 4.66 per cent of the average; the standard error of the unweighted geometric mean was only 1.66 per cent of the average. In no case is there any difference of this magnitude in favor of the arithmetic mean. Over the six year period from 1915 to 1920, which was marked by great price increases, the logarithmic measures were more reliable 17 times out of 24. The conclusion to which these comparisons lead is that during normal times there is little to choose between the arithmetic and logarithmic measures of price change in the matter of sampling reliability, but that the arithmetic measures are much less reliable during periods of extreme disturbance.

Averages of the standard errors of the different index numbers for the periods 1891-1913 and 1914-1926 are shown in the following table. These are expressed as percentages of the averages to which they refer.

TABLE 96

Average Standard Errors of Various Index Numbers

(1) Type of index number	(2) Average standard error, 1891-1913 (1892-1913 for fixed base index numbers), as percentage of mean (based on 195-205 price quotations)	(3) Average standard error, 1914-1926, as percentage of mean (based on 385-391 price quotations)
Unwtd. arithmetic, fixed base relatives	1.46	2.09
Unwtd. geometric, fixed base relatives	1.46	1.49
Wtd. arithmetic, fixed base relatives	2.59	2.42
Wtd. geometric, fixed base relatives	2.64	2.35
Unwtd. arithmetic, link relatives	.87	1.03
Unwtd. geometric, link relatives	.87	.94
Wtd. arithmetic, link relatives	1.61	1.64
Wtd. geometric, link relatives	1.61	1.56

These figures give a fairly accurate indication of the sampling reliability of these different index numbers. In comparing these averages it must be remembered that the standard errors of the fixed base measures tend to increase somewhat as the base becomes farther removed, because of the secular increase in dispersion. This does not invalidate the comparison of the various measures relating to fixed base relatives over a given period. Fixed base measures relating to different periods are not directly comparable, however, nor are link and fixed base measures. Again, we must note in interpreting these figures that the number of quotations included is one of the factors upon which the standard error of the mean depends. The figures in column (3) above are based upon samples each consisting of 385 to 391 observations; the figures in column (2) relate to samples of from 195 to 205 observations. If the dispersion were constant and the degree of intercorrelation were the same in the two groups,[1] the errors of averages based upon 390 measures would be about two-thirds as great as the errors of averages based upon 200 observations. Since no account of intercorrelation has been taken in these calculations, the larger errors of the later averages are due to the wider dispersion of prices during the war years.

The identity of the results for arithmetic and geometric measures during the years from 1891 to 1913 is noteworthy. The standard errors of arithmetic and geometric averages of unweighted link relatives during this period averaged .87 of 1 per cent. For unweighted fixed base relatives the standard errors averaged 1.46 per cent in both cases. The standard errors are greater for weighted averages, but again there is no marked difference between the measures relating to arithmetic and geometric averages.

The results for the years 1914-1926 indicate that under the price conditions of this period the standard errors of unweighted averages of link relatives computed from about 390 cases amounted to about 1 per cent of the means to which they related, while the standard errors of weighted averages of link relatives slightly exceeded 1.5 per cent. In each case geometric averages had somewhat lower standard errors than arithmetic averages. Standard errors of averages of fixed base relatives, which ran from 1.49 per cent for unweighted geometric measures to 2.42 per cent for weighted arithmetic averages, were abnormally high for the period covered, because of the exceptionally wide dispersion of prices.

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[1] In the present case it is not true that the degree of intercorrelation is the same in the two groups. Many of the series added by the Bureau of Labor Statistics for the period beginning in 1913 represent duplications of series previously used. Thus four series of wholesale prices of wheat were added to the one series employed before 1913, and two series of cattle prices were added to the two series entering into the earlier calculations. The correlation between these different series relating to the same commodity is not perfect, hence the addition of the new series adds something to the reliability of the index number. But the additions do not have the same effect, in reducing the sampling error, as would an equal number of price series which were quite independent of those previously used.

It will, in general, be true of index numbers of prices that the reduction in the sampling error with an increase in the number of commodities included will be less than that which the theory of sampling would lead one to expect. No general rule can be laid down, since the effect of an increase in the number of commodities in a given case will depend upon the degree to which these duplicate quotations previously included. Professor Fisher has suggested that if account be taken of weights, instead of number of commodities, a closer approach to results consistent with probability theory will be secured. (*The Making of Index Numbers*, pp. 336-340.)

Under conditions of normal dispersion, over a corresponding period, these would be about two-thirds as large.[1]

In computing the various measures of reliability given above use has been made of the customary formula for the standard error of a mean. One of the conditions necessary to the application of this formula is that the various observations shall be independent of each other. This condition is not fulfilled perfectly in combining prices. It is obvious, for example, that the quotations on the various grades of wheat are correlated, and that the price of steel billets is not independent of the price of pig iron. Professor A. L. Bowley has recently completed a comprehensive study in which he has sought to determine the precise degree of intercorrelation prevailing between wholesale commodity price series. He has found that the degree of intercorrelation is not as great as is commonly assumed. He is able to reach quite definite conclusions as to the number of independent observations to which the recorded quotations employed in the Sauerbeck-Statist index are equivalent. The 45 commodity price series actually employed in constructing the index are equivalent to 39.5 independent price series, each with the standard deviation typical of the 45. But since 10 of these 45 series are themselves averages of 10 pairs of original quotations, allowance is made, in another calculation, for the presence of these additional series. The 55 series of price quotations are the equivalent, according to Bowley's calculations, of 43.5 uncorrelated commodity price series, each with the standard deviation typical of the 55.

These conclusions are based upon the hypothesis that the secular movements of the various price series are independent. The adjustments noted above are intended as corrections for correlation between short period variations of these price series.

In tracing relations among the 45 primary price series studied, Bowley found only 52 cases (out of 990 possible combinations) in which the correlation was as great as .30. The quantities correlated were derived by expressing the price relative of a given commodity in a given year as a percentage of the general price index for that year. When the effects of rectilinear trends upon the individual commodity price series were eliminated, only 35 correlations reached or exceeded a value of .30. (Although the full 990 coefficients were not computed, the procedure employed probably resulted in the finding of most, if not all, of the significant correlations.)[2]

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[1] There is a sharp distinction, of course, between the "sampling error" to which the above measures apply and the "instrumental error" with which Professor Irving Fisher deals in *The Making of Index Numbers* (pp. 225-229). Professor Fisher is concerned with the degree of mathematical accuracy which may be secured in handling certain price and quantity data. He concludes, after comparing the results secured by the application of the thirteen most accurate formulas to the same data, that the "probable error" involved seldom reaches one-tenth of one per cent, and is generally very much smaller than this figure. This measure of Fisher's does not relate to the error involved in generalizing the results obtained from a sample, and does not stand in any simple relation to the sampling errors given in Tables 95 and 96.

[2] This study is described in "The Influence on the Precision of Index Numbers of Correlation between the Prices of Commodities" in the *Journal of the Royal Statistical Society*, Vol. 89, Part II (1926) pp. 300-319. The investigation covered the period

Without making a study similar to that of Bowley it is impossible to state precisely the degree of intercorrelation between the price series utilized in the present investigation. It seems reasonable, upon an inspection of the figures, to assume that approximately the same degree of intercorrelation found in the Sauerbeck series prevailed among the price series entering into our pre-war calculations. There seems, however, to be considerably more intercorrelation and duplication in the 390 series used in calculations for the years since 1913. It may be estimated that the price series covering the years 1890-1913 (varying from 195 to 205 in number) are the equivalent of about 160 uncorrelated series, and that the series available for the years 1914-1926 (varying from 385 to 391) are the equivalent of about 270 uncorrelated series. (Some account has been taken, in arriving at these estimates, of the differences in the markets from which quotations are drawn.) Upon the basis of these estimates the standard errors of the various index numbers relating to the pre-war years should be increased by about 12 per cent, and the standard errors for the years from 1914 to 1926 should be increased by about 20 per cent.

It is possible to compare one of the present results with a similar figure derived by Bowley. Bowley finds that the probable error of an unweighted geometric mean of relatives computed from the Sauerbeck-Statist list of wholesale prices for the year 1913 (1901 being the base) was 2.25 per cent. (The probable error is here expressed as a percentage of the mean.) The probable error of the corresponding index for the United States for the year 1913 (on the 1902 base) was 1.22 per cent. Bowley's measure is derived, in this case, on the assumption that the price series employed are equivalent to 40 independent series, while the American figure is derived on the assumption that the 205 relatives are equivalent to 160 independent observations. Under these conditions, and assuming approximately the same degree of price dispersion in the two countries, the probable error of the American figure would be about half that of the British average. The actual measures are very close to this relation. (The difference of one year between the base periods would have no material influence upon the degree of dispersion.)

2. A Monthly Price Index: Changes in the Price Level Over Twelve-Month Intervals

In later sections dealing with the dispersion and displacement of prices use is made of monthly link relatives, each link covering a twelve-month period. That is, the price of a commodity in January, 1926, is expressed as a percentage of the price in January, 1925; the price in February, 1926, is expressed as a percentage of the price in February, 1925, and so on. These relatives may be

1867-1913. The results of an earlier study by Bowley, touching upon the same subject, are given in a memorandum of the London Cambridge Economic Service (*Special Memorandum No.* 5, February, 1924) "Relative Changes in Price and other Index Numbers."

used in constructing index numbers of prices. The indexes thus secured differ materially from those of the usual type, which measure changes in reference to a constant base. This method of measuring price changes was first suggested by A. W. Flux,[1] but has not been widely employed. It possesses certain distinct advantages, particularly in connection with the measurement of internal shifts in price relations.

Weighted geometric means of such relatives, computed from the prices of 100 commodities,[2] are plotted in Figure 24. This index covers the years 1920-1926. The wholesale price index of the United States Bureau of Labor Statistics has been put in the same form (i. e. each monthly value has been expressed as a percentage of the value for the same month during the preceding year) and carried back, by months, to 1901. It will be noted that there is a very close correspondence between the two sets of index numbers during the period covered by both. The index of the Bureau of Labor Statistics is shown in its original form (1913 = 100) as well as on the twelve-month link basis, to permit comparison.

The movements of the twelve-month link index differ from those of the fixed base index and require, of course, a different interpretation. The points at which plotted values of the link index lie upon the 100 line mark the dates when the price level was precisely the same as at dates twelve months preceding. A high point on this curve marks the date when the price level was at its maximum, in comparison with the level twelve months preceding. Thus a high value was reached in April, 1920. Until October, 1920, the index was above the values recorded twelve months earlier, but by smaller amounts than in April. The lowest point of the price index was reached in June, 1921. Not until May, 1922, was the price level back to that prevailing twelve months earlier. The index rose after June, 1921, because after that date the index was not as far below the figure for the twelfth month preceding as it was in June. Viewed in this light, the low point of that price cycle came in June, 1921, instead of in January, 1922, when the lowest value in reference to a fixed base was recorded.

This price level index traces out the major cyclical movements very clearly. The turning points precede, in general, those in the

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[1] "The Measurement of Price Changes," *Journal of the Royal Statistical Society*, Vol. 84 (1921), pp. 167-190.

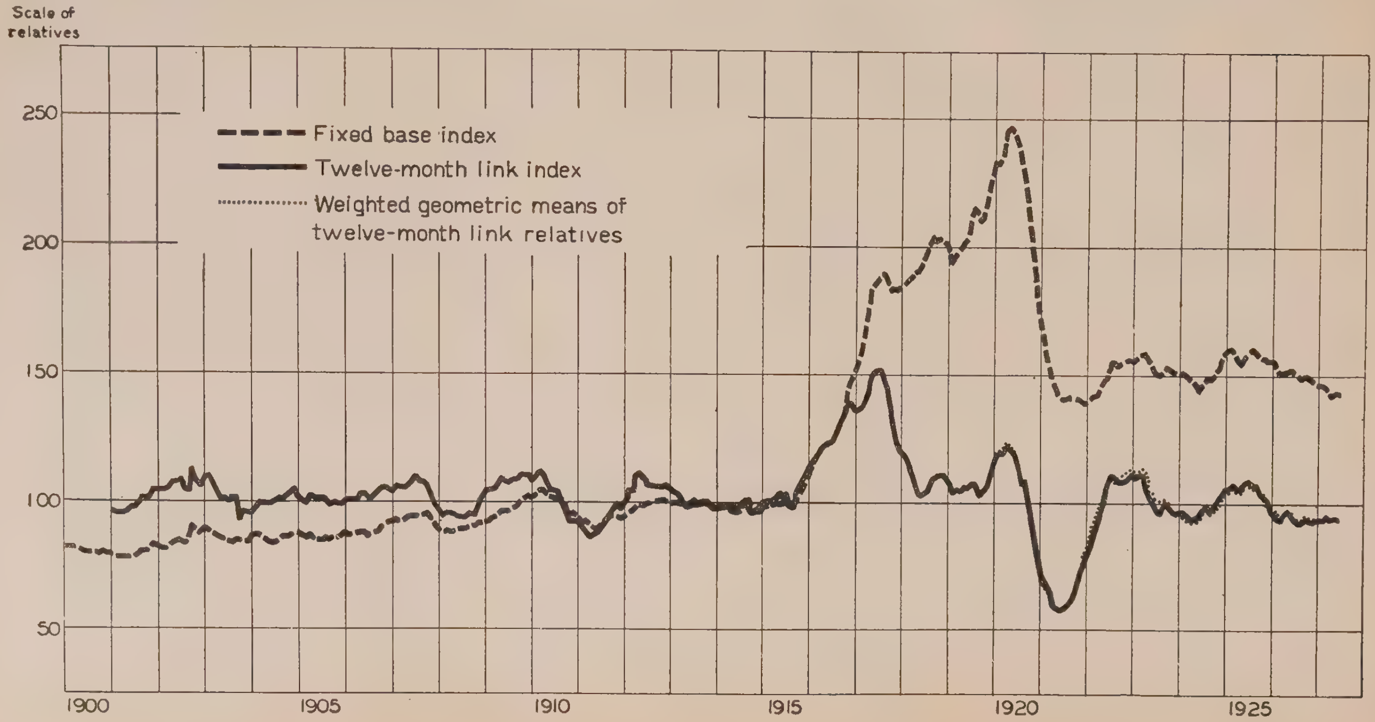
[2] For the list of these commodities, see p. 271. The monthly values of the index are given in Table 103.

FIGURE 24

Fluctuations in Wholesale Prices, by Months, 1900-1927.

Comparison of a Fixed Base Index and a Twelve-Month Link Index.

(The fixed base index is that of the United States Bureau of Labor Statistics. The base is 1913. The twelve-month link index covering the entire period is derived from the index of the Bureau of Labor Statistics. Weighted geometric means of twelve-month link relatives are plotted for the period 1920-1926.)



fixed base index of the usual type. This is clear from the following summary.

TABLE 97

COMPARISON OF TURNING POINTS, UNITED STATES BUREAU OF LABOR STATISTICS INDEX (1913=100) AND TWELVE-MONTH LINK INDEX

(1) Period number[1]	(2) Turning points Fixed base index	(3) Turning points Twelve-month link index	(4) Number of months by which link index precedes (—) or lags behind (+) fixed base index
7 (low)	July, 1901	April, 1901	— 3
8 (high)	Oct., 1902	Oct., 1902	0
9 (low)	July, 1904	Oct., 1903	— 9
10 (high)	Oct., 1907	July, 1907	— 3
11 (low)	Feb., 1908	Feb., 1908	0
12 (high)	April, 1910	March, 1910	— 1
13 (low)	June, 1911	April, 1911	— 2
14 (high)	Sept., 1913	May, 1912	—16
15 (low)	Nov., 1914	Nov., 1914	0
16 (high)	Sept., 1918	July, 1917	—14
17 (low)	Feb., 1919	Sept., 1919	+ 7
18 (high)	May, 1920	April, 1920	— 1
19 (low)	Jan., 1922	June, 1921	— 7
20 (high)	April, 1923	Jan., 1923	— 3
21 (low)	June, 1924	April, 1924	— 2
22 (high)	March, 1925[2]	June, 1925	+ 3

[1] The numbers refer to the periods defined on p. 81.

[2] This value was 161.0. The real turning point came, however, in August, when a second high of 160.4 was recorded. The turn in the link index came two months before the latter date.

There is no necessary relationship which would cause the turns in the twelve-month link index always to precede the turns in a fixed base index, but this will generally be so. This is because the rate of advance (or of fall) in the fixed base index of prices is retarded before the maximum (or minimum) value is reached. Only under rather exceptional conditions will the twelve-month index lag behind the fixed base index in its major turns.[1]

The reference of price changes to a date twelve months before has certain advantages. If there were seasonal changes in the price index (of which there is no clear evidence) they would be eliminated. Again, the values of such an index fluctuate about the base line (i. e. the 100 line). The effect of a consistent trend is not, of course, eliminated, but it appears in a form somewhat different from that to which we are accustomed. The effect of an upward trend on a twelve-month index of this sort would be to increase the number of entries above 100, intensifying and lengthening the swings of the index above the base line. A downward trend would have the reverse effect.

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[1] This will happen when a minor movement (upward or downward) in the fixed base index has occurred during the twelve months preceding the major turn, this earlier movement being in the same direction as the ensuing major movement, and at a higher rate than that which follows the major turn.

An index of this type cannot, of course, replace those of the familiar fixed base type, but it is useful in presenting price fluctuations in a somewhat different light. In its construction it accords with the current practice of comparing prices at a given date with prices prevailing at a date twelve months earlier. And, as will appear later, it is a useful companion measure to certain measures of dispersion and displacement which appear to be most significant on a twelve-month basis.

The measures discussed in the preceding pages relate to a first and extremely important aspect of price instability—instability of the general level of prices. There have been presented different types of index numbers which measure, with varying degrees of accuracy, the changes through which the level of wholesale prices has passed since 1890. Certain points of some technical interest, relating to weighting and to the reliability of different types of index numbers, have been noted in passing. It has not been the purpose of this section, however, to discuss the technique of index number construction, and no attempt has been made to deal with the various "crossed" formulas derived by Professor Irving Fisher.

But it is an inadequate survey of the price problem which contents itself with the information concerning price changes which is yielded by index numbers of the type given above. These are merely averages of diverse distributions of price relatives, and they relate only to one aspect of price behavior. Other important aspects are still to be described. When this has been done, and appropriate measures have been computed, the relation of instability in the price level to other types of price instability may be considered.

IV Price Dispersion[1]

Of those aspects of price behavior which are not reflected in the movements of an index number of the orthodox type, probably the most obvious is the variation, or dispersion, of price relatives about their average values. It is this factor of dispersion which now calls for consideration.

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[1] I regret that I was not able to include in this section the results secured by Dr. Maurice Olivier in his study of price dispersion (*Les Nombres Indices de la Variation des Prix*, Paris, Giard, 1927, pp. 90-98.) His book came into my hands after the text of this volume had gone to the printer. This study of price dispersion, based upon the movements of the price series used in the construction of the Federal Reserve Board's index of wholesale prices for France, covers the years 1920-1924, by months. Arithmetic and logarithmic measures of dispersion are employed. Dr. Olivier finds, during this period, a tendency toward a positive relationship between changes in the price level in France and the dispersion of price relatives in natural form.

1. Nature and Significance of Price Dispersion

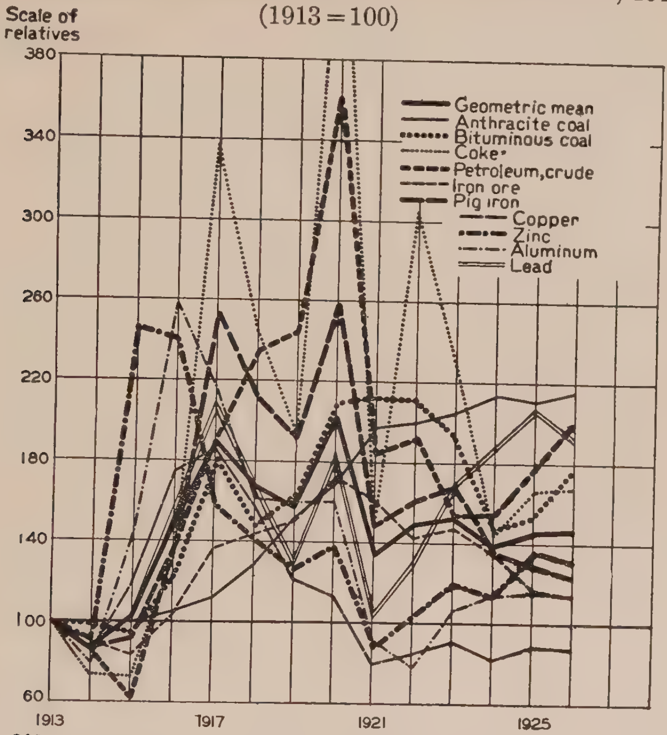
The nature of price dispersion is indicated by the column diagrams plotted above in Figure 21. In some years there is a fairly close concentration of the various price relatives about their mean values. The figure for the year 1926, showing unweighted link relatives on the natural scale, exemplifies this situation. In other years there is a wide scatter, the individual price relatives deviating materially from the average. The column diagram of unweighted fixed base relatives on the natural scale for the year 1918 illustrates dispersion of this type.

The dispersion of price relatives has practical significance from two different viewpoints. If our purpose be to measure the degree of change in the price level between two different dates we may treat each price relative as a single observation, a single attempt to measure the change in the purchasing power of the dollar. When the price relatives are closely concentrated about their average value we have a situation corresponding to that which prevails when a very accurate field piece is directed upon a target, or when a group of experienced surveyors measure a certain distance. Each individual observation is marked by a very small margin of error. The average of these individual observations carries, therefore, considerable weight as a close approximation to the true value. When, on the other hand, the price relatives are widely dispersed each one gives a measure of the change in the purchasing power of the dollar which is marked by a wide margin of error, and the average has less significance as a representative figure. This must be taken to mean that the force which is affecting the price level (or the purchasing power of the dollar) is less direct in its incidence, that it is obscured and complicated by the action of a diversity of factors which affect individual commodity prices. Each price relative constitutes a less accurate observation upon the change in the purchasing power of the monetary unit than is the case when the relatives are closely concentrated.

An index number of prices of the usual type may be looked upon, therefore, as a measure of the intensity of the force, or combination of forces, which is affecting the general price level. An

FIGURE 25

Relative Prices of Ten Minerals, with their Geometric Mean, 1913-1926.
(1913 = 100)



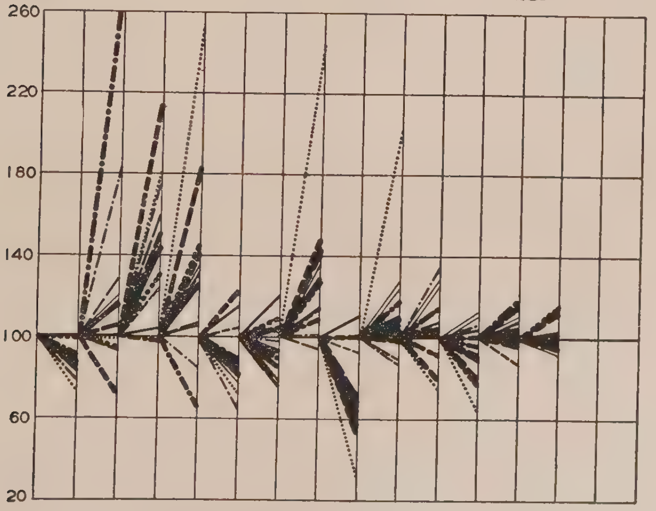


FIGURE 26

Link Relatives of Ten Minerals, with their Geometric Mean, 1913-1926.

(The x-scale and the legend of Figure 25 apply also to Figure 26.)

index of dispersion is a measure of the intensity of the disruptive forces, the forces which are operating not to change the price level but to change individual commodity prices in unequal degrees. The less direct the incidence of the force which is acting upon the price level, and the greater the relative importance of the host of specific price-making factors which affect individual commodities, the more widely dispersed will the price relatives be. The validity and the significance of any index number depend, therefore, upon the dispersion of the price relatives upon which it is based, and a measure of dispersion is a necessary complement to such an index number.

The disruptive forces possess interest and significance in their own right. For every inequality of movement affects the buying and selling relations upon which the movement of goods depends. Every inequality of movement introduces some element of instability into the price system. This point may perhaps be made clearer in terms of specific commodity prices. Figure 25 shows the movements from 1913 to 1926 of the relative prices of ten commodities, on the 1913 base. Only ten are plotted, for the sake of simplicity. A truer picture of the actual situation would be given if 400 or more series were represented. In Figure 26 link relatives of the same commodities are plotted. In both charts the movements of the geometric means of the individual relatives are indicated. The point need not be argued that the differences in the degree of price change shown in these charts involve material readjustments in trade relations. The importance of these relations is obvious when the commodities considered are those entering into a connected series of trading operations, such as cattle, hides, leather and shoes. Movements of relatives derived from wholesale prices of these commodities are shown in Figure 27.

Individual commodity prices are constantly changing, and since most price-making factors are localized and specific in their incidence, any large group of commodities will show many inequalities in the direction and degree of change. Such inequalities are more pronounced at certain times than at others. Interest attaches, therefore, to variations in the degree of dispersion, and to the relation of such variations to fluctuations in the price level and to changes in business conditions.

These matters have received some attention from students of prices in the past. F. Y. Edgeworth touched upon this subject in his classic *Memoranda*.[1] Wesley C. Mitchell has made use of an in-

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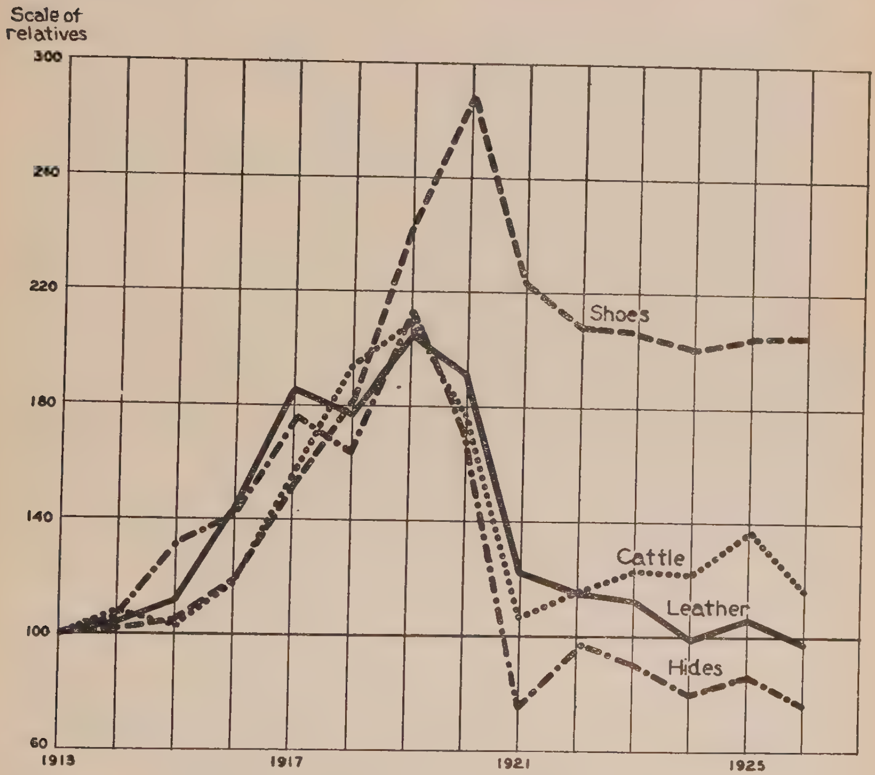
[1] Reprinted in *Papers Relating to Political Economy*, MacMillan, London, 1925, Vol. I.

FIGURE 27

Dispersion of Related Price Series.

Relative Prices of Cattle, Hides, Leather and Shoes, 1913-1926.*

(1913 = 100)



*The prices here plotted relate to the commodities numbered 15, 42, 166 and 441.

genious method of picturing price dispersion, and has discussed the relation of price dispersion to changes in the general price level.[1] Norman Crump, in a more recent study,[2] has tested various methods of measuring price dispersion and has suggested that it may be possible to trace some relation between the degree of dispersion and the future course of the price level.

It remains to test these relations, and to inquire as to the general economic significance of price dispersion. The first step is the construction of a suitable measure of dispersion.

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[1] *Business Cycles*, University of California Press, 1913. *The Making and Using of Index Numbers* (Part I of *Bulletin 284*, U. S. Bureau of Labor Statistics), 1921.

[2] "The Interrelation and Distribution of Prices and their Incidence upon Price Stabilization." *Journal of the Royal Statistical Society*, Vol. 87, Part II, 1924.

2. The Measurement of Price Dispersion

Most of the customary measures of variation have been applied from time to time in the measurement of price dispersion. The *modulus* ($\sigma\sqrt{2}$) was employed by Edgeworth, though the use to which he put the measure differed somewhat from that in mind at present. Wesley C. Mitchell made effective use of deciles in picturing the dispersion of price relatives. Dr. Silverstolpe has employed the mean deviation.[1] Irving Fisher, in connection with the studies described in *The Making of Index Numbers*, made use of the standard deviation, computed from relative prices and from logarithms of relative prices. Norman Crump experimented with the arithmetic standard deviation and the logarithmic standard deviation. The measures finally employed by Crump were three in number, the arithmetic standard deviation, the arithmetic coefficient of variation, and a measure of the "angle of deviation," derived from the standard deviation and the arithmetic mean.[2] A. L. Bowley has made use of the "mean percentage divergence," a measure similar to the mean deviation, except that the variations which are averaged are the percentage deviations of individual relatives from their geometric mean.[3]

In the present study there have been employed several measures of dispersion, corresponding to the different averages cited above. The basic measure, in every case, is the standard deviation. This is in natural form when the price relatives are combined as natural numbers. If we assume, in handling price relatives, that we are dealing with material which has most significance in logarithmic form, then the standard deviation in logarithmic form, or some derivative of it, is the logical measure to employ. This measure has precisely the same meaning in respect to logarithms that the standard deviation has in dealing with natural numbers. For convenience in interpretation the standard deviation has been modified somewhat in securing the measures of dispersion. A fractional part of the standard deviation ($.6745\sigma$, the quantity which defines the limits of the 50 per cent zone, in a normal curve) has been employed, and this has been expressed in each case as a percentage of the average to which it relates. The term "index of dispersion," as used in this study, refers to the measure derived from the logarithmic standard deviation.[1]

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[1] Silverstolpe's measures have been published in the *Göteborgs Handels och Sjöfarts-Tidning*.

[2] Crump's measures of dispersion are now published currently in the *Financial Times* of London.

[3] "Relative Changes in Price and other Index Numbers", *London and Cambridge Economic Service*, Special Memorandum No. 5, February, 1924. It may be noted that Professor Bowley uses the term "variability of prices" for what is here termed price dispersion. The term variability is used in the present study in a different sense.

The measure of dispersion derived from natural numbers gives the percentage limits, measured from the arithmetic mean, within which 50 per cent of the price relatives would fall if the distribution of price relatives were normal. The index of dispersion derived from logarithms gives the approximate percentage limits, measured from the geometric mean, within which 50 per cent of the price relatives would fall if the distribution of logarithms of price relatives were normal. The assumption that the distributions are normal is not true either of natural or logarithmic distributions, except in occasional instances, but the validity of the measure, for comparative purposes, does not rest upon the truth of this assumption. Essentially, the standard deviation in natural and logarithmic form is being used as a measure of dispersion. A fractional part of the

[1] The following formulas indicate the processes employed in computing the measures of dispersion from relatives in natural and in logarithmic form:

$$\text{Measure of dispersion (natural)} = \frac{.6745\sigma}{\text{M}} \times 100$$

$$\text{Logarithmic standard deviation} = \sigma_{\log} = \sqrt{\frac{\Sigma(\log \text{m} - \log \text{G})^2}{\text{N}}}$$

$$\text{Index of dispersion} = \frac{[\text{anti-log}(+.6745\,\sigma_{\log}) - 1] + [1 - \text{anti-log}(-.6745\,\sigma_{\log})]}{2} \times 100$$

The symbols employed above are

m: a price relative
M: the arithmetic mean of price relatives
G: the geometric mean of price relatives
σ: the standard deviation of price relatives
$\sigma_{\log}$: the standard deviation of logarithms of price relatives.

A given value of the standard deviation in logarithmic form represents, of course, a certain percentage deviation above the geometric mean and a different (smaller) percentage deviation below the geometric mean. It seems desirable, in converting to natural numbers, to average these percentage deviations, instead of using the two percentages. A true account of the percentage dispersion which corresponds to a given distribution of logarithms would only be given by the two figures, but the convenience of a single measure outweighs the slight loss of accuracy resulting from the averaging. The formula for the index of dispersion indicates the method of averaging. The following figures illustrate the process:

Arithmetic mean of unweighted logarithms of link relatives, 1892 = 1.97523
Geometric mean = 94.5
Standard deviation of logarithms ($\sigma_{\log}$) = .04870
$.6745\sigma_{\log}$. = .03285

$$\text{Index of dispersion} = \frac{[(1.079 - 1) + (1 - .928)] \times 100}{2} = 7.6$$

standard deviation is cast into percentage form, in order to secure a measure which has immediate significance and which may be interpreted in terms which will be generally understood.

Thus we might describe the price change between 1891 and 1892 in this fashion: The unweighted geometric mean of 195 price relatives in 1892, on the 1891 base, is 94.5. The index of dispersion has a value of 7.6 which indicates that approximately 50 per cent of the individual link relatives differ from the mean, 94.5, by more than 7.6 per cent, while roughly 50 per cent differ from the mean by less than 7.6 per cent. This situation may be compared with that in 1920. In the latter year the geometric mean of relatives on the 1919 base is 111.0; the index of dispersion is 15.7 per cent, more than twice as great as in 1892.

The various measures of dispersion secured in analyzing frequency distributions of annual price relatives are presented in Table 98. Brief comparisons of the different types of dispersion measures may precede the more general discussion of their significance.

The dispersion of fixed base relatives is greater than the dispersion of link relatives in all cases except where the two coincide (i. e. in the first year after the base year, in each of the three periods covered by the fixed base relatives). This is, of course, to be expected. The scatter of price relatives when the base is two years or more distant is naturally greater than the scatter with reference to the preceding year as base.

A detailed comparison of the dispersion of weighted[1] and unweighted price relatives shows that there is no constant relation between the two sets of measures. Under usual price conditions the weighted and unweighted indexes of dispersion follow much the same path. This is particularly marked in the case of logarithms of link relatives, though even here there are certain years when the differences are material. During the war years the unweighted dispersion indexes rose to higher levels than the weighted. For fixed base relatives in natural form the dispersion of the unweighted relatives was very much greater than that of the weighted relatives, the difference being accentuated from 1915 to 1918. For all types of distributions, covering the years from 1891 to 1926, the dispersion of the weighted relatives was less than that of the unweighted relatives 74 out of 136 times. (The comparison in each case is between distributions differing only in the matter of weighting.)

[1] The weights employed are given in Appendix Table I.

TABLE 98

Dispersion of Wholesale Prices in the United States, 1891-1926

(1) Year	(2) No. of price series	(3) Measures computed from fixed base relatives[1]	(4)	(5)	(6)	(7) Measures computed from link relatives	(8)	(9)	(10)
		Unwtd arithmetic	Wtd. arithmetic	Unwtd. geometric	Wtd. geometric	Unwtd. arithmetic	Wtd. arithmetic	Untwd. geometric	Wtd. geometric
1891	195					8.9	9.7	8.8	10.6
1892	195	7.2	7.2	7.6	7.3	7.2	7.2	7.6	7.3
1893	195	10.9	12.8	10.6	12.2	8.6	8.6	8.3	8.3
1894	195	11.4	12.6	12.3	13.3	7.6	7.8	7.8	7.9
1895	195	12.8	17.0	12.7	14.5	9.2	10.6	9.0	9.8
1896	195	14.0	16.1	15.2	15.8	8.9	9.0	9.8	9.8
1897	195	13.1	11.6	14.4	12.9	10.8	9.5	10.4	9.7
1898	195	14.2	12.8	14.4	13.3	8.1	7.3	7.8	7.7
1899	195	15.2	17.0	15.7	16.1	11.9	11.9	10.3	10.5
1900	195	15.7	16.1	16.5	15.8	8.4	9.4	8.2	8.4
1901	195	16.5	15.5	16.6	15.5	8.8	7.7	8.5	7.9
1902	195	16.8	18.1	17.0	17.6	8.4	8.5	8.7	8.6
1903	205	7.6	9.2	7.7	9.2	7.6	9.2	7.7	9.2
1904	205	11.6	14.0	12.0	14.1	8.2	9.8	8.6	10.2
1905	205	12.6	13.5	11.5	13.5	6.5	7.1	6.8	7.4
1906	205	13.8	12.6	13.4	12.6	7.3	7.9	7.3	7.7
1907	205	14.0	12.3	13.7	15.7	7.1	5.4	7.4	5.7
1908	205	13.8	12.1	13.6	12.8	8.9	8.3	9.1	8.7
1909	205	13.6	13.6	14.0	13.9	7.4	7.8	7.2	7.6
1910	205	16.7	15.9	16.3	15.5	7.6	8.2	7.4	7.9
1911	205	20.4	14.8	17.5	14.6	9.9	9.1	9.3	8.7
1912	205	19.4	13.5	16.5	13.8	7.2	7.3	7.4	7.3
1913	205	16.5	13.9	15.7	14.1	7.6	8.7	8.0	8.4
1914	391	8.8	7.1	8.2	7.4	8.8	7.1	8.2	7.4
1915	391	43.5	21.6	17.9	12.6	25.9	14.0	15.0	10.6
1916	391	62.2	22.7	22.2	14.6	17.0	16.2	13.8	13.7
1917	391	47.9	23.0	23.7	20.1	13.0	12.3	13.8	12.4
1918	389	37.5	19.2	21.8	18.1	13.3	13.5	13.9	14.2
1919	391[2]	21.8	16.4	18.4	17.8	16.3	12.0	16.6	11.9
1920	391	22.4	20.3	22.2	21.6	16.5	16.2	15.7	15.7
1921	391	22.1	21.2	23.3	23.5	17.3	18.0	18.3	18.3
1922	391	19.4	18.4	20.8	21.0	13.3	12.8	12.4	11.7
1923	390	19.7	18.8	21.2	21.5	9.7	11.0	9.6	11.0
1924	390	20.2	18.5	21.0	21.0	9.7	8.3	8.7	8.3
1925	387	18.1	16.2	18.8	16.3	10.4	13.9	9.0	11.5
1926	385	19.1	18.0	19.0	17.4	7.6	8.5	7.7	8.9

[1] Bases: first period, 1891; second period, 1902; third period, 1913.

[2] 389 link relatives were employed.

There is apparent a slight tendency for the dispersion of the unweighted relatives to be greater than that of the weighted, a tendency which was pronounced during the years of violent price change succeeding the outbreak of the war. The fact that the weighted measure follows a less erratic course during the war years, coupled with the initial assumption that the weighted measure is more representative of price conditions, has led to its general use in the present study.

The measures of dispersion derived from relatives in logarithmic and in natural form are directly comparable, since both have been expressed as percentages of the mean values. Of 136 pairs of measures the index numbers of dispersion derived from logarithms are found to be smaller in 70 cases. There is practical equality between the two. The natural measures, however, were marked by much wider fluctuations during the war years, this being particularly true of the fixed base relatives.

Before a choice can be made between arithmetic and logarithmic measures of dispersion, it is desirable that their relative reliability be determined. This reduces to the familiar problem of computing the probable or standard errors of these measures, in order to determine their liability to sampling fluctuations. The standard errors of the unweighted standard deviations are given in percentage form in the table on the next page.[1]

The greater reliability of the logarithmic measures of dispersion is manifest, from a survey of this table. In each of the 25 cases in which comparison is possible the standard error of the logarithmic measure is materially less than that of the corresponding arithmetic measure. The standard error of the logarithmic standard deviation of link relatives exceeds 2 per cent only once, and is in the neighborhood of 1 per cent for most of the years covered. The standard error of the arithmetic standard deviation of link relatives rises as high as 23 per cent in 1915. For the fixed base relatives the errors are greater. The largest error for the logarithmic measures is 4.0 per cent of the standard deviation, the largest for the arithmetic measures is 35.7 per cent. The reason for the much greater errors of the arithmetic measures, especially during the war

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[1] The standard error of the standard deviation, for any type of distribution, is given by the formula:

$$\sigma_\sigma = \sqrt{\frac{\mu_4 - \mu^2_2}{4\mu_2 \cdot N}}$$

Since the moments of the logarithmic distributions are in terms of logarithms, the standard error emerges as a logarithm, while for the arithmetic measures it is in natural form. By taking the antilogarithm of the former, and expressing the latter as a percentage of the standard deviation to which it relates, these measures are cast into comparable form.

In applying the above formula for the standard error of the standard deviation, no allowance has been made for the intercorrelation between prices which was discussed in the preceding section. No correction is necessary for the comparisons which concern us at present. If interest attaches to the absolute values of these measures a correction similar to that explained on p. 247 should be made.

TABLE 99

STANDARD ERRORS OF STANDARD DEVIATIONS COMPUTED FROM PRICE RELATIVES, 1891-1926

(Expressed as percentages of the measures to which they relate)

(1) Year	(2)	(3)	(4)	(5)
	Standard error of standard deviation of unweighted fixed base relatives[1]		Standard error of standard deviation of unweighted link relatives	
	Arithmetic	Logarithmic	Arithmetic	Logarithmic
1891				.81
1892	6.86			.90
1893	9.15			.94
1894	5.63			.78
1895	13.38			1.10
1896	8.58			1.21
1897	5.25			1.50
1898	8.05			.74
1899	7.26			1.26
1900	7.04			.80
1901	7.52			.83
1902	7.75			1.04
1903	5.85			.73
1904	6.22			.94
1905	8.57			1.09
1906	10.62			.83
1907	10.82			1.14
1908	7.45			.81
1909	8.32			1.04
1910	14.79			.87
1911	19.31			1.32
1912	19.84			.84
1913	11.04			1.00
1914	12.00	.94	12.00	.94
1915	29.74	3.86	23.52	2.77
1916	35.70	4.00	4.18	1.32
1917	34.99	3.04	4.84	1.28
1918	30.76	2.64	4.95	1.09
1919	20.73	1.71	8.75	1.69
1920	6.43	1.78	5.89	1.02
1921	5.00	1.84	3.48	1.04
1922	4.13	1.84	6.05	.84
1923	3.90	1.51	6.78	.72
1924	5.81	1.80	15.45	1.09
1925	5.12	1.23	13.74	1.01
1926	5.35	1.43	6.60	.76

[1] Bases: first period, 1891; second period, 1902; third period, 1913.

years, is found in the large second and fourth moments of the arithmetic distributions. The use of logarithms serves to reduce the dispersion and the lack of symmetry during times of pronounced price change.

These differences are so pronounced as to leave no room for doubt as to which is the more reliable of these two types of measures. Index numbers of dispersion computed from different samples of a given population, using logarithms of price relatives, may be expected to fluctuate within relatively narrow limits. The reverse is true of arithmetic measures of dispersion. So large are the errors to which these measures are subject that the results secured from different samples may be expected to fluctuate within very wide limits, and little confidence may be attached to a given value. Because the index of dispersion computed from logarithms of price relatives seems, on the whole, to be much more reliable and more significant than the arithmetic measure, it has been employed generally in the present study.[1] The labor of computation, by the method suggested above (page 220), is no greater than that involved in computing the arithmetic standard deviation.

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[1] This conclusion is not in accord with that reached by Mr. Norman Crump, who stated that "the logarithmic standard deviation......simply leads back to the same result as is attained directly from the arithmetic standard deviation." ("The Inter-relation and Distribution of Prices and Their Incidence upon Price Stabilization," p. 179.) The conditions under which Mr. Crump's statement would be true appear to be seldom realized in dealing with distributions of price relatives. As a relationship which holds approximately Crump gives $\sigma_{\log} = \log G - \log (A - \sigma) = \log (A + \sigma) - \log G$, where σ and $\sigma_{\log}$ represent, respectively, the arithmetic and logarithmic standard deviations, and A and G represent, respectively, the arithmetic and geometric means. When the logarithmic standard deviation as thus derived is compared with that computed directly from the logarithms, material differences are found. For the year 1915 the error is equal to 86 per cent of the true value of the standard deviation; for the year 1916 the error amounts to 26 per cent of the true value. In 26 out of 36 years for which the relationship was tested the discrepancy exceeds 2.58 times the standard error of the logarithmic standard deviation. (These results relate to unweighted link relatives of average annual prices for the period 1891-1926.)

Another method of approximating the measure of dispersion derived from the standard deviation of logarithms has been suggested by Professor Irving Fisher. Using the symbol d for the antilogarithm of the logarithmic standard deviation, less unity, Fisher gives

$$1 + d = \frac{\sqrt{A^2 - AH} + A}{\sqrt{AH}}$$

where A and H represent, respectively, the arithmetic and harmonic means of the data. (*The Making of Index Numbers*, p. 392.) This approximation appears to be much closer than that suggested by Crump. For 391 unweighted link relatives in 1915 Crump's formula involved an error equal to 86 per cent of the true value; the result secured from Fisher's method differs by but 3.6 per cent from the true value. For 1916 the error in Crump's method amounted to 26 per cent of the true value; Fisher's method involved an error of 1.8 per cent. These were the two years of greatest disturbance, when the errors would be expected to be at their maximum.

Since the true value may be readily derived, and since some error is involved in using even Fisher's approximation, the value secured directly from the logarithms is probably to be preferred as a measure of dispersion.

Discussions of the logarithmic measure of dispersion are to be found in the *Journal of the Royal Statistical Society*, Vol. 86 (1923) pp. 428-430 (a review by Professor Yule of Fisher's *Making of Index Numbers*), and in the *Nordisk Statistik Tidskrift*, Band 2 (1923) pp. 402-408 ("Zweck und Struktur einer Preisindexzahl," by L. v. Bortkiewicz).

3. Annual Indexes of Price Dispersion, 1890-1926

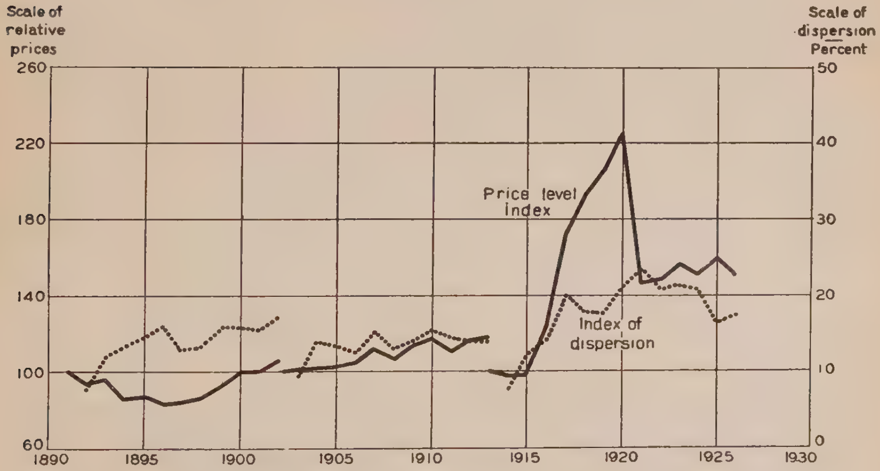
In Figure 28 the dispersion indexes based on weighted logarithms of fixed base relatives are plotted, together with the weighted geometric means of the same data. To facilitate comparison of the measures for different periods the dispersion indexes for the three periods are superimposed, in Figure 29. (The numerical values are given in Table 98.)

FIGURE 28

Index Numbers Measuring Changes in the Level of Wholesale Prices and in Price Dispersion, 1892-1926.

Weighted Geometric Means and Indexes of Dispersion Computed from Fixed Base Relatives for the Periods 1891-1902, 1902-1913, 1913-1926.

(The first year in each period is the base for that period.)



The general story which the charts tell is a fairly simple one. In the case of the fixed base relatives the indexes measuring the dispersion of fixed base relatives follow much the same course during the first two periods. There is a sharp initial increase followed by a much slower increase which, in the second period, becomes virtually oscillation about a constant level. During the last period the increase continues until 1921, with a sharp break, however, in 1918 and 1919.[1] After 1921 there is a pronounced decline to 1925, with a minor increase in 1926. Comparing the three periods, we find that the index of dispersion was smallest (14.1) at the end of the second period (1902-1913), somewhat larger at the end of the third period (17.4) and greatest at the end of the first period (17.6). The disturbance of price relations between 1891 and 1902 was slightly greater, as measured by this index, than between 1913 and 1926, a somewhat surprising result in view of the violence of the price movements since 1913. In this comparison the reference is, of course, to the situations at the ends of the periods mentioned. If the intervening years be considered, the third period was marked by much greater disturbance than the first. By 1925, however, the dispersion of fixed base relatives had declined to a level that may be viewed as approximately normal, considering the time interval between the given year and the base year.

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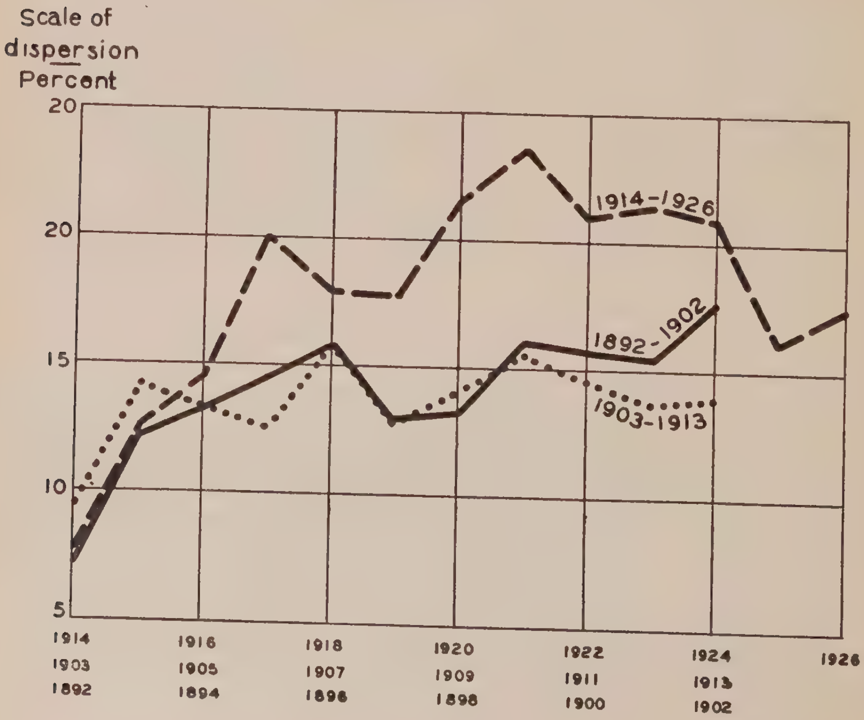
[1] It is probable that the decline in dispersion in 1918 and 1919 was in part due to price regulation during the war.

FIGURE 29

Comparison of Indexes of Price Dispersion Computed from Fixed Base Relatives for the Periods 1891-1902, 1902-1913, 1913-1926.



During each of the three periods covered by the fixed base measures described above, the initial movements of the indexes of dispersion have been upward. This upward trend continued, as has been noted, throughout the whole of the first period, but in the second and third periods it was checked. The maximum value in the second period (1902-1913) was recorded in 1907, while the maximum value in the third period (1913-1926) came in 1921. These results bear upon a question of some importance: Does the dispersion of fixed base relatives tend to increase indefinitely, the further removed the base becomes, or is there a "ceiling" to the movements of dispersion indexes of this type? Is there a critical value beyond which the index of dispersion cannot, or does not, rise? The evidence of the indexes for the separate periods defined above is conflicting on this point, and the periods covered are too short to permit of generalization. In order to secure an index covering a longer period the series of price relatives on the 1891 base were carried forward through 1926.[1] Measures computed from these relatives are given in Table 100, on the next page. These measures are plotted, on the ratio scale, in Figure 30.

This index shows that the dispersion of relatives on the 1891 base increased, with minor interruptions, between 1892 and 1921, and that there was a slight decline between 1922 and 1925, with an upturn in 1926. We may, however, secure a truer account of the behavior of this index by breaking the entire period into two parts, the first including the years 1892 to 1914, the second the years from 1915 to date. During the first period we find the rapid initial increase in dispersion and the subsequent slowing up which has been described by Wesley C. Mitchell, Irving Fisher and others. The flattening out process which marks the course of the index on the ratio chart was interrupted by the price disturbances of the war period. Between 1915 and 1921 the upward movement of the index was accelerated. The slightness of this acceleration gives evidence of the stability which the index of dispersion had attained by 1915. By that year the relatives on the 1891 base were widely dispersed, and although the violent price disturbances of the next several years increased the dispersion somewhat, the effect was not pronounced. It may be noted that the index of dispersion in 1917, on the 1891 base, with a value of 26.8, exceeded by only a slight margin the index for the same year (1917) on the 1913 base. The

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[1] The number of price series used in these computations was 195, except for the years 1918 and 1925, when 194 series were used, and 1926, for which 193 series were available.

TABLE 100

INDEXES OF PRICES AND OF PRICE DISPERSION, 1891-1926

Unweighted geometric averages and indexes of dispersion computed from relatives on the 1891 base.

(1) Year	(2) Geometric mean	(3) Index of dispersion
1891	100.0	
1892	94.5	7.6
1893	93.9	10.6
1894	84.3	12.3
1895	82.8	12.7
1896	79.6	15.2
1897	79.3	14.4
1898	83.0	14.4
1899	90.2	15.7
1900	97.3	16.5
1901	96.3	16.6
1902	99.6	17.0
1903	100.3	17.6
1904	99.5	16.6
1905	101.6	16.8
1906	106.7	17.6
1907	113.0	19.3
1908	104.7	18.8
1909	107.6	19.6
1910	111.5	21.6
1911	109.3	21.3
1912	113.2	21.7
1913	113.6	22.8
1914	113.0	22.6
1915	115.6	24.8
1916	145.4	24.9
1917	199.9	26.8
1918	232.8	29.1
1919	239.9	27.3
1920	269.7	30.4
1921	176.9	30.7
1922	176.0	28.8
1923	187.6	29.2
1924	184.9	29.1
1925	191.5	28.3
1926	183.6	29.6

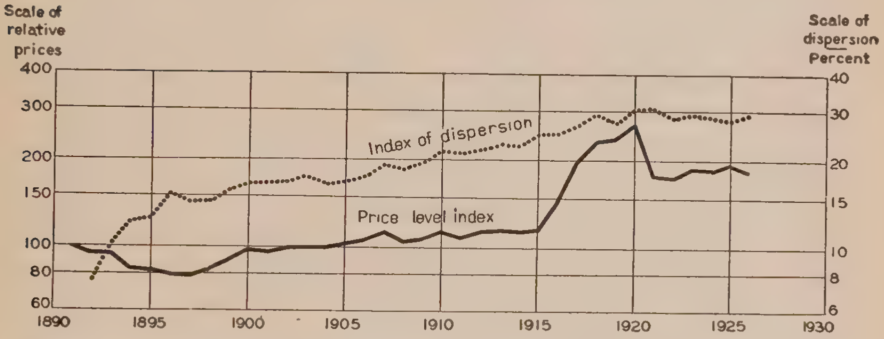
value of the latter, as computed from unweighted relatives, was 23.7.

The record for the years 1892 to 1921 indicates that the dispersion of fixed base relatives may increase over a long period of years. There may be an ultimate check to this movement, but we cannot at present say whether the 1921 value represents a true upper limit or only a temporary high. There are *a priori* reasons for expecting that, in the absence of such exceptional disturbances as the war years brought, the dispersion of fixed base relatives would increase at a decreasing rate, tending finally toward approximate

FIGURE 30

INDEX NUMBERS MEASURING CHANGES IN THE LEVEL OF WHOLESALE PRICES AND IN PRICE DISPERSION, 1891-1926.

Unweighted Geometric Means and Indexes of Dispersion Computed from Fixed Base Relatives.
(1891 = 100)



stability at a relatively high level. This means that after a certain degree of dispersion has developed there may be material changes in the relative positions of fixed base relatives, but that the movement is confined within fairly definite percentage limits of the mean.[1] The behavior, during the years preceding 1914 and the years following 1921, of the index of dispersion on the 1891 base indicates that such a tendency is present.[2]

When we deal with link relatives the increase in dispersion due to the constantly increasing time interval between the given years

[1] The length of time which elapses before the stage of approximate stability is attained probably varies, depending in part upon the price situation in the year chosen as base for the relatives, in part upon developments during particular periods of time. The results secured from the study of the three sets of fixed base relatives employed in the present study point to such variation. Professor A. L. Bowley's figures, relating to the dispersion of 60 price relatives on the 1901 base ("Relative Changes in Price and other Index Numbers," p. 7), show an initial period of increase to 1906, with no regular tendency to increase between 1906 and 1913. It will be recalled that the relatives for the second period (1902-1913, on the 1902 base) show a similar tendency, maximum dispersion being recorded in 1907.

[2] There is, perhaps, an analogy between fixed base price relatives and biological characteristics of the human race, in respect to dispersion. Concerning the latter Galton has written: "If family variability had been the only process in simple descent that affected the characteristics of a sample, the dispersion of the race from its mean ideal type would indefinitely increase with the number of generations, but reversion checks this increase, and brings it to a standstill." (*Typical Laws of Heredity in Man*, p. 10.) The existence of an apparent "ceiling" to the dispersion of price relatives indicates that there is a check, also, to the indefinite increase in the dispersion of prices. Certain economic factors which would tend to check the indefinite scatter of prices come to mind at once, but we may not speculate here on the character of the forces which bring about regression or reversion in the movements of price relatives.

and the base year is not present as a complicating factor. The dispersion of link relatives may be studied by comparing the successive frequency distributions of link relatives shown in Figure 21. The modifications during the price revolution of the war and post-war years are particularly marked. The peaked distributions of the earlier years are flattened and spread out, to contract again in the years following 1921.

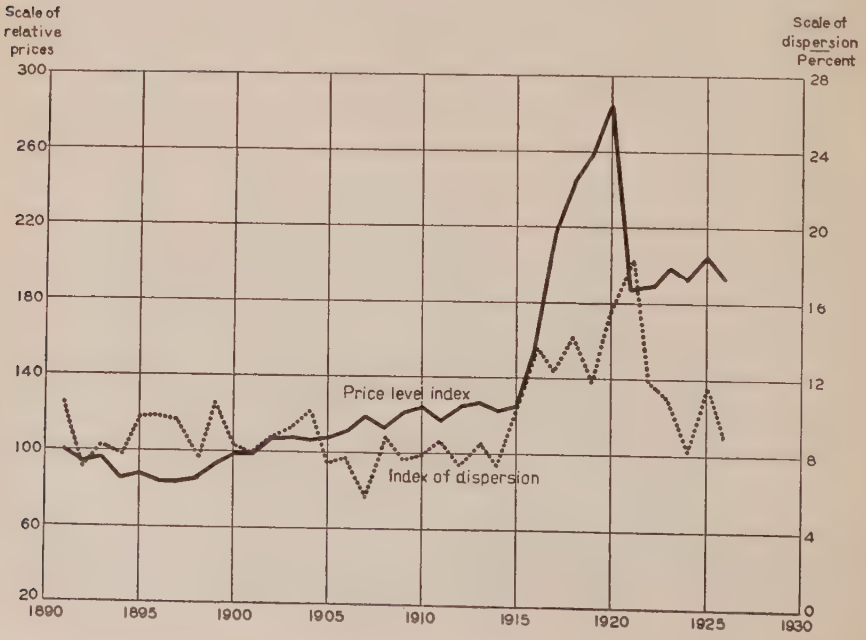
This comparison of frequency distributions is suggestive, but lacks precision, in so far as the measurement of dispersion is concerned. A more accurate representation of the changes in the dispersion of link relatives from year to year is afforded by Figure 31, in which is plotted an index of dispersion computed from weighted logarithms of annual link relatives for the period 1891-1926. (The figures appear in Table 98). The geometric means of link relatives, chained on the 1891 base, are plotted in the same figure.

FIGURE 31

Index Numbers Measuring Changes in the Level of Wholesale Prices and in Price Dispersion, 1891-1926.

Weighted Geometric Means and Indexes of Dispersion Computed from Annual Link Relatives.

(The geometric means are chained on the 1891 base.)



The general movement of this index of dispersion was gradually downward during the period prior to 1914. Relatively high values were obtained in 1891, from 1895 to 1897, in 1899 and in 1904. During the years of prosperity between 1904 and 1907 the degree of dispersion declined. The dispersion of prices in 1907 was the lowest recorded in the entire study. There was a sharp increase with the readjustments between 1907 and 1908, followed by an irregular downward movement to 1914. From 1905 to 1914 the average value of the index of dispersion was 7.7.

Between 1914 and 1916 there was a further increase in dispersion, the figure for the latter year being materially greater than any recorded during the 25 years preceding. The cause is found, of course, in the readjustments due to the European war. The index of year-to-year dispersion remained at approximately the 1916 level in 1917 and 1918, with a minor decline in 1919, following the end of the war. The downward movement lasted but the one year, however. In 1920 and 1921 there were upward movements comparable to those of 1915 and 1916, but on a much higher level. The disturbance of price relations, as judged from the index of dispersion, was greater between 1920 and 1921 than it was in any period of equal length since 1890. One may go further. The disturbance between 1920 and 1921, as measured by a dispersion index of 18.3, was greater than the disturbance between 1891 and 1902(index of dispersion, relatives on 1891 base, = 17.6), and exceeded the disturbance between 1902 and 1913 (index of dispersion, relatives on 1902 base, = 14.1). In this one interval of twelve months there was a more violent "scattering" of prices than during either of the two eleven year periods named.

Following the extreme dispersion recorded between 1920 and 1921 the index declined materially in 1922 and 1923, and in 1924 fell to 8.3. This represents an approximately normal degree of dispersion, judged by pre-war standards. Not since 1914 had a comparable value been recorded. There was a considerable rise (compared with pre-war changes) in 1925, followed by a decline in 1926.

§An Index of Dispersion Based on Group Index Numbers

An index of dispersion may be derived from the 28 sub-group index numbers which the Bureau of Labor Statistics now publishes in its annual volumes on *Wholesale Prices*. The absolute values thus secured differ, of course, from those obtained when all the individual price relatives are employed, but general changes in price dispersion are reflected in this index. The labor of computation is much lighter when the sub-group index numbers are employed.

The process is identical with that followed when the data are individual price relatives. The geometric mean of the 28 relative numbers and the logarithmic standard deviation are computed. (No weights were used in these calculations, although weights had been employed, of course, in the computation of the origional group index numbers.) From the latter measure is derived an index of dispersion of the type previously described. This index is shown below, together with the index of dispersion computed from the individual price relatives, weighted. Results secured from both link and fixed base relatives are given.

TABLE 101

Comparison of Indexes of Dispersion Derived from Individual Price Relatives and from Sub-group Index Numbers of the United States Bureau of Labor Statistics

(1) Year	(2) Measures of dispersion of fixed base relatives (1913 = 100)	(3)	(4) Measures of dispersion of link relatives	(5)
	Derived from individual price relatives, weighted	Derived from 28 sub-group index numbers	Derived from individual price relatives, weighted	Derived from 28 sub-group index numbers
1914	7.4	5.3	7.4	5.3
1915	12.6	11.2	10.6	9.3
1916	14.6	12.2	13.7	11.5
1917	20.1	13.7	12.4	9.0
1918	18.1	12.2	14.2	10.7
1919	17.8	12.9	11.9	11.4
1920	21.6	15.6	15.7	9.9
1921	23.5	17.1	18.3	12.9
1922	21.0	17.9	11.7	7.6
1923	21.5	17.3	11.0	7.1
1924	21.0	16.4	8.3	5.3
1925	16.3	13.5	11.5	5.9

The index of dispersion computed from the group index numbers fluctuates on a lower plane than that based upon individual relatives, but it traces much the same general course. The most pronounced difference between the two measures relating to fixed base relatives is that the index based on groups shows the dispersion to have been at its maximum in 1922, whereas the other index reached its peak in 1921. In the case of link relatives, the two index numbers move in opposite directions between 1918 and 1919 and between 1919 and 1920, but there is agreement at all other dates. More confidence must attach to the indexes based on individual relatives, but the group index numbers provide simple and fairly accurate measures of the general changes in the degree of dispersion. For certain purposes the differences between the various sub-group index numbers might be of more interest than differences between individual price relatives.

4. Monthly Indexes of Price Dispersion, 1906-1908, 1920-1927

In the computation of monthly measures of dispersion the same method has been employed as in handling annual data. The monthly index of dispersion is thus a measure, in percentage form, of the approximate limits of the zone within which half of the price relatives in a given month will be found. Each relative is secured by expressing the price of a commodity in a given month as a percentage of the price of the same commodity in the preceding month.

In Table 102, below, are given index numbers of dispersion computed from weighted logarithms of monthly link relatives for the years 1906-1908, 1920-1926. The relatives were derived from the price quotations for 100 important commodities, selected from the general list given in Appendix Table I.[1]

TABLE 102

INDEXES OF DISPERSION COMPUTED FROM MONTHLY LINK RELATIVES OF COMMODITY PRICES, 1906-08, 1920-26

(Based upon the weighted relatives of 100 commodities)

(1) Month	(2) 1906	(3) 1907	(4) 1908	(5) 1920	(6) 1921	(7) 1922	(8) 1923	(9) 1924	(10) 1925	(11) 1926
Jan.	3.7	2.9	4.2	5.7	6.5	5.6	4.1	4.0	4.7	4.4
Feb.	3.4	2.3	2.4	5.3	7.5	4.9	5.0	4.6	5.0	3.6
Mar.	2.4	3.3	4.7	4.9	5.5	4.5	3.7	5.0	5.7	4.6
Apr.	2.8	2.5	5.1	8.2	4.3	2.7	3.4	3.0	4.2	2.4
May	2.8	4.6	4.0	5.2	6.3	4.8	3.8	3.4	4.0	3.6
June	3.2	3.9	4.4	6.0	4.4	4.6	3.1	4.1	4.0	2.6
July	2.3	3.0	3.7	4.6	6.1	4.6	3.7	4.0	3.2	2.6
Aug.	3.1	3.1	3.7	5.9	4.3	6.9	3.6	4.6	2.8	2.6
Sept.	2.6	3.2	2.9	7.2	8.2	5.2	4.5	4.8	3.8	4.0
Oct.	3.0	4.5	4.2	6.8	6.2	3.9	4.9	4.2	4.7	6.0
Nov.	2.6	5.1	2.9	6.6	5.6	5.0	5.5	4.0	4.1	4.4
Dec.	2.2	3.9	2.4	6.7	2.6	3.3	3.7	3.5	5.3	5.4

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[1] Following are the numbers of the commodities employed. These may be identified by reference to Table I. Commodities which were substituted for others in some of the calculations are indicated by the numbers in parentheses.

Farm products (14 commodities): nos. 1, 2, 4, 6, 14, 15, 18 (1906-08:19), 25, 31, 37, 42, 47, 51, 56.

Foods (18 commodities): nos. 64, 69, 70 (1906-08:71), 74 (1906-08:76), 78, 84 (1925:83, 1906-08:89), 106, 109, 116, 118 (1906-08:119), 120, 132 (1906-08:128), 135 (1906-08:130), 138, 146, 149, 150, 158.

Cloths (18 commodities): nos. 166, 178 (1906-08:177), 180, 183, 185, 187, 191, 195, 196, 199, 203, 206, 210, 213, 216, 217, 221, 226.

Fuel (8 commodities): nos. 233, 235, 237, 238, 239, 243 (1906-08:244), 246 (1906-08: 247), 249 (1925:248).

Metals (12 commodities): nos. 259, 260, 266, 269, 275, 279 (1906-08:282), 284 (1906-08:280), 293, 295, 296, 300, 302.

Building materials (9 commodities); nos. 303, 310 (1906-08:306; 1925:311), 317 (1925:316), 324, 327 (1925:328), 330, 338, 343, 348.

Chemicals (6 commodities): nos. 360, 361 (1906-08:362), 376 (1906-08:377), 382, 393, 396.

House-furnishings (7 commodities): nos. 406, 412, 414, 415, 418, 424, 428.

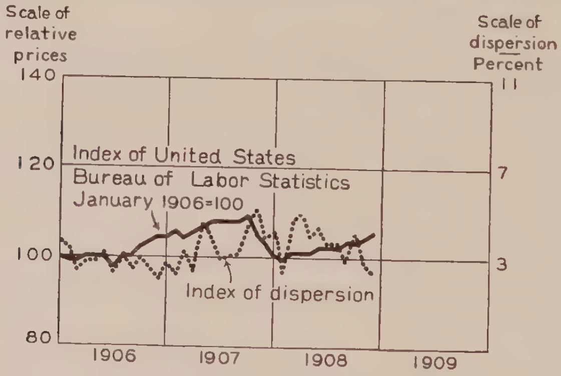
Miscellaneous (8 commodities): nos. 437 (1906-08:436), 441, 444, 449 (1906-08: 448), 450, 451, 454 (1906-08:455), 457.

The index for the years 1906-1908 is plotted in Figure 32, together with an index of changes in the general level of prices. January, 1906, is taken as the base of the price index.

FIGURE 32

Monthly Index Numbers of Wholesale Prices and of Price Dispersion, 1906-1908.

(Changes in the level of prices are measured by the index of the United States Bureau of Labor Statistics, with the base shifted to January, 1906. The index of dispersion is computed from monthly link relatives, weighted, of 100 commodities.)



The story covering the three pre-war years is fairly clear. During the 16 months preceding May, 1907, the index of dispersion of monthly link relatives had an average value of about 3. Between September, 1906, and February, 1907, there was a relatively sharp increase in the level of wholesale prices (an increase of 6 per cent), but there was no material change in the degree of dispersion. In May and June of 1907 there was a sudden increase in dispersion, then a drop back again to a level of about 3 until October. Thereafter, until November, 1908, the index of dispersion remained high, with the exception of sudden declines in February and September, 1908. That is, the disturbance of price relations continued not only during the sharp liquidation from November, 1907, to February, 1908, but also during the ensuing depression. The highest single value, 5.1, was recorded in November, 1907 (the first month of sharp decline in the price level) and in April, 1908. There was a decline in the degree of dispersion beginning in May, 1908, but not until November, when the worst of the depression was over and the general price index had started a definite upward movement, did the index of dispersion return to the 1906 level.

It is worthy of note that the graph of the dispersion index gives a saw-tooth effect, with sharp movements from month to month. In February, 1908, in the middle of the period which was marked by a fairly high degree of price disturbance, there was a single low value, even below the 1906 level. This is probably in part accounted for by the smallness of our sample (100, for these monthly observations) and the relatively high probable error of the measure of dispersion based upon weighted measures. The somewhat erratic movements probably reflect, in addition, definite changes in underlying price conditions. They suggest that during liquidation and the accompanying price disturbance there are relatively calm spells. From January to February, 1908, there seems to have been such a spell, while from September to October, 1908, there was a sharp disturbance, breaking the decline in the index which was then in process. Because of the relative smallness of the sample, however, such a generalization may only be put forward tentatively.

Omitting the 13 months from October, 1907, to October, 1908, we secure 3.0 as the average value of the monthly index of dispersion. This will serve for comparison with the post-war figures.

The process of post-war price readjustment, in so far as it is measured by the dispersion of monthly link relatives, is portrayed in Figure 33. The monthly index of dispersion here plotted is based upon substantially the same commodities (100 in number) as were employed in constructing the index for 1906-08. A monthly index showing changes in the level of wholesale prices, with reference to January, 1921, as base, is also plotted.

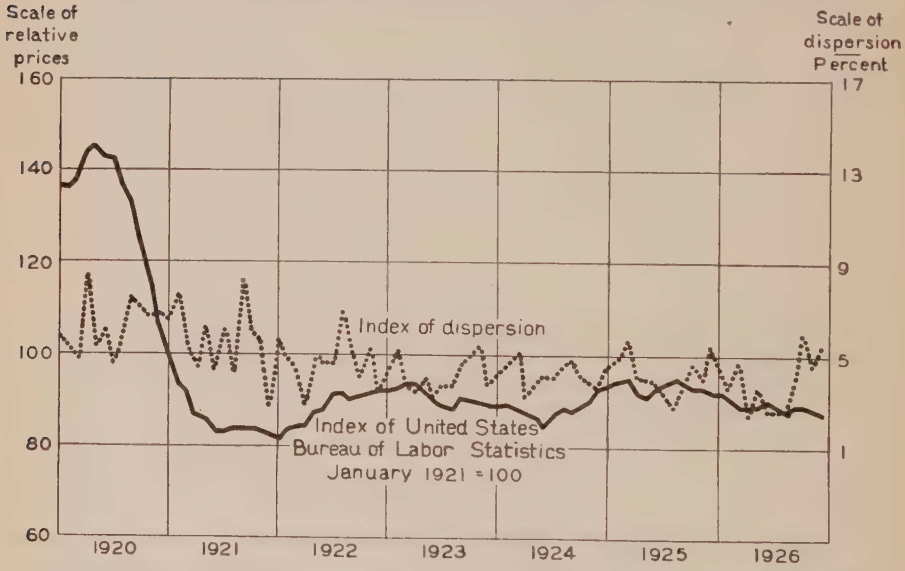
The dispersion during the later period is upon a distinctly higher level than during the pre-war years, this being particularly marked during 1920 and 1921, when the month-to-month dispersion was greatest. During the liquidation and depression of 1907-08 the value of the dispersion index fluctuated between 3 and 5. In 1920 and 1921 it fluctuated between 4.5 and 8. (The index, being logarithmic, is not affected by the difference in price levels.) There is evidence here that the degree of disturbance in 1920 and 1921 was materially greater than in 1907-08, and that, during the years 1922-1926, the month-to-month price variations were more pronounced than they were in a relatively stable period before the war.

The graph of the index of monthly dispersion from 1920 to 1926 gives a picture of a spasmodic but none the less clearly marked process of stabilization. From an average value of about 7 during the months of most severe readjustment at the end of 1920 and the

FIGURE 33

MONTHLY INDEX NUMBERS OF WHOLESALE PRICES AND OF PRICE DISPERSION, 1920-1926.

(Changes in the level of prices are measured by the index of the United States Bureau of Labor Statistics, with the base shifted to January, 1921. The index of dispersion is computed from monthly link relatives, weighted, of 100 commodities.)



beginning of 1921, the index declined to an average of 4.1 during the last four years covered. This last figure, it has been noted, is well above the average value (3.0) during the fairly stable months of the period 1906-1908.

The broken and uneven character of the decline from 1920 to 1923 reënforces the conclusion, suggested above, that the economic changes which are reflected in such an index are themselves spasmodic, and that there are months of slight change even during a period of crisis and severe liquidation. July, 1920, April, June, August, and December, 1921, were months of comparative calm. Here again the smallness of the sample (100) and the use of weights which differ materially in value[1] may explain some of these irregularities, but they are probably due in part to an inherent characteristic of price changes from month to month during a period of disturbance. Even in relatively quiet times the changes in dispersion from month to month may vary considerably, but the range of the movements is much less than during the critical period of liquidation.

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[1] An unweighted index of dispersion, based upon the same commodities as were employed in constructing the weighted index, was computed for the months of 1920 and 1921. The weighted and unweighted measures show no difference of any consequence except for September, 1921, when the unweighted index rose to only 6 per cent, as compared with 8 per cent for the weighted. They are very close together at all other points. It is not likely, therefore, that the disparity of weights accounts for the sharp changes from month to month.

Another method of measuring price changes has been employed by A. W. Flux and, in the measurement of dispersion, by Norman Crump. This method, based upon twelve-month link relatives, was described in an earlier section. (A twelve-month link relative is derived by expressing the price of a commodity in a given month as a percentage of its price in the same month of the year preceding.) In the following table are given geometric means and indexes of dispersion computed from such twelve-month relatives, weighted, for the 100 commodities listed above.[1] The period covered extends from January, 1920, to September, 1927. The measures for the years 1920-1926 are plotted in Figure 34.

The index of dispersion computed from twelve-month link relatives differs in several respects from the two types already employed, and throws an interesting light upon the price movements of this period. Since the dispersion which is being measured is that which occurs over twelve months, the average value of the index is considerably higher than that of the one-month link relatives. It is also noticeably higher than the dispersion of annual link relatives. The latter, of course, are based upon average annual prices, and the process of averaging would be expected to reduce the dispersion of the individual figures. Finally, the twelve-month index is not marked by the sharp irregularities which were so pronounced in the index based upon monthly links. It follows a much smoother course, and its major fluctuations are clearly apparent. This, again, is to be expected from the nature of the data. The minor month-to-month changes which reflect the play of random forces are smoothed out before twelve months have elapsed. A change which persists after twelve months is, presumably, related to major price and economic changes. The elimination of seasonal influences by the use of a twelve-month period, a point suggested by Crump, is another factor of some consequence in reducing the irregularities found in the index of monthly link relatives.

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[1] See footnote, p. 271. In computing the measures for 1926 and 1927 certain minor omissions and substitutions were made.

TABLE 103

GEOMETRIC MEANS AND MEASURES OF DISPERSION COMPUTED FROM TWELVE-MONTH LINK RELATIVES OF COMMODITY PRICES, 1920-1927

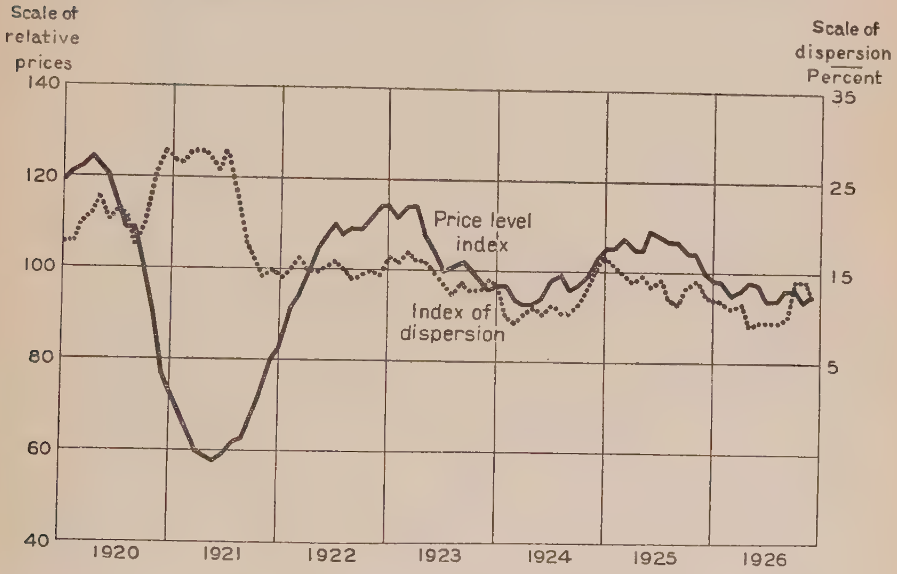
(Based upon the weighted relatives of 100 commodities)

Month	Geometric mean	Index of dispersion	Geometric mean	Index of dispersion
	1920		1921	
Jan.	118.8	17.9	72.6	27.2
Feb.	120.5	18.2	68.5	26.7
Mar.	121.6	19.9	65.0	27.9
Apr.	124.2	21.0	59.7	27.8
May	122.1	23.1	58.9	27.6
June	120.4	20.5	57.7	26.1
July	113.4	21.3	59.1	28.0
Aug.	108.5	20.3	61.0	23.4
Sept.	108.6	17.6	62.7	18.7
Oct.	97.9	21.0	68.4	16.5
Nov.	89.5	25.3	72.7	14.5
Dec.	78.3	28.0	80.0	15.2
	1922		1923	
Jan.	83.0	14.7	114.2	16.3
Feb.	91.0	15.2	111.9	16.2
Mar.	93.8	16.5	114.3	17.1
Apr.	98.6	15.2	114.1	16.3
May	103.9	15.1	107.9	15.8
June	108.0	15.7	104.6	15.2
July	109.9	15.9	100.4	13.4
Aug.	108.1	15.2	101.2	12.3
Sept.	108.7	14.1	102.0	13.4
Oct.	109.1	14.3	100.2	13.0
Nov.	112.2	15.0	97.6	13.1
Dec.	113.7	14.4	96.1	14.2
	1924		1925	
Jan.	96.7	13.3	104.9	16.4
Feb.	96.5	9.8	104.9	15.3
Mar.	93.9	9.7	106.5	14.5
Apr.	92.9	10.4	104.6	14.0
May	93.4	10.9	104.9	14.7
June	93.5	10.4	108.5	13.7
July	97.8	11.5	107.5	14.1
Aug.	99.2	10.5	106.7	11.9
Sept.	95.9	10.5	107.1	11.5
Oct.	97.2	11.3	104.4	13.4
Nov.	99.4	13.0	104.2	14.0
Dec.	102.8	15.3	99.9	12.5
	1926		1927	
Jan.	98.2	12.0	93.5	12.2
Feb.	97.6	12.2	93.9	11.3
Mar.	94.6	11.1	95.2	10.3
Apr.	96.3	11.4	95.0	11.4
May	97.9	8.9	95.1	10.7
June	97.1	9.5	94.5	12.4
July	94.2	9.5	96.5	12.2
Aug.	93.8	9.3	97.5	12.7
Sept.	95.6	10.1	98.3	12.9
Oct.	95.9	13.9		
Nov.	93.9	14.0		
Dec.	94.6	12.6		

FIGURE 34

Monthly Index Numbers of Wholesale Prices and of Price Dispersion, 1920-1926.

Weighted Geometric Means and Indexes of Dispersion Computed from Twelve-Month Link Relatives of 100 Commodities.



The general swings of the dispersion index tell a fairly consistent story of the changes in the degree of price disturbance during this period. From January to May, 1920, this index increased from 18 per cent to 23 per cent, values which are quite high in comparison with the index in more normal years. The first effect of the break in the price level was a sharp drop in dispersion, a decline of 5.5 points in 4 months. There is an indication here, similar to that found in certain of the studies of regional price differences, that the immediate effect of a major price recession is in the direction of equalization. The continuation of the decline brought an abrupt change after September, 1920. Within three months after that date the index had risen by more than ten points. This sharp increase probably reflects the spread of price difficulties and the beginning of drastic and general liquidation in the last quarter of 1920. The index of dispersion continued at a very high level until July, 1921. Then, as the mean values of the twelve-month link relatives started upward again, the degree of dispersion declined sharply. By November, 1921, the dispersion had declined to a level approximately equal to that maintained in the later years. The disturbance of prices appears, on this basis, to have been most acute between December, 1920, and July, 1921. By November, 1921, the exceptional difficulties were past.

During the rise of prices to a peak early in 1923 the index of dispersion fluctuated about a fairly constant level. The peak for this movement was attained in March, 1923, when the dispersion index had a value of 17.1. Thereafter both price and dispersion indexes declined. The index of dispersion reached a low of 9.7 in March, 1924. The price decline of 1923-24 appears, thus, to have effected a substantial reduction in price inequalities (if we may consider the scatter of prices to be an evidence of inequalities). The decline of 1920-21 had the same final effect, but in the course of this decline there developed inequalities greater than those which had existed at the peak of prices.

Following the low of March, 1924, the index of dispersion rose slightly until September, then more sharply, reaching a peak, in January, 1925. The rise was more pronounced than any that had occurred since 1920, but the level attained was low in comparison with the 1920-21 values. This rise in 1924 accompanied a distinct upward movement in average prices. From January, 1925, to May, 1926, there was an irregular but substantial decline in dispersion, the index falling from 16.4 to 8.9. Succeeding this fall came a minor increase in dispersion, and this was followed by twelve months of fluctuation about a constant and relatively low level.

The index of dispersion based upon twelve-month link relatives is not marked by the irregularities which detract from the utility of the index computed from monthly links. It possesses the smoothness which a fixed base index would have, but is more sensitive to current price movements than is the fixed base measure. It is free, moreover, from the tendency toward a secular increase in dispersion which affects an index derived from fixed base relatives. We have seen that for annual comparisons measures of dispersion computed from annual link relatives seem preferable to other types. When monthly prices are employed, an index of dispersion computed from twelve-month link relatives appears to throw most light upon changes in internal price relations.

5. THE DISPERSION OF PRICES AND CHANGES IN THE PRICE LEVEL

In the preceding account of the dispersion of prices passing reference has been made to the relation between price dispersion and movements of the general level of prices. This subject requires somewhat more extended treatment.

Certain previous investigations have touched upon this subject. As a result of these studies the theory has been advanced that with a rising price level the dispersion of price relatives increases, while the degree of dispersion declines with falling prices. In the first edition of *Business Cycles* Wesley C. Mitchell illustrated the dispersion of relative prices by means of a chart showing the movements of the deciles. The period covered extended from 1890 to 1910. The data were relative prices on the base 1890-1899. From a study of the movements of deciles computed from these relatives Mitchell concluded that "concentration around the median becomes denser when prices fall and less dense when they rise," and that "Relative prices are squeezed together by the pressure of business depression, and spring apart when the pressure is relaxed by returning activity."[1] F. Y. Edgeworth reached a somewhat similar conclusion, namely, "when the index number was rising there was much greater disturbance of the standard deviations of price relatives." Although Edgeworth was of the opinion that, in general, the inferential connection ran "from rising index number to greater standard deviation,"[2] he suggested that there might be great changes in dispersion without corresponding changes in the price level. Norman Crump, in the study of price dispersion to which reference has been made, agrees with the general thesis that rising prices mean increasing dispersion, and suggests that changes in the price level may be predicted from this relationship. A rising price level, in Crump's view, is accompanied by an increase of dispersion. Sooner or later the price maladjustments which result from wider dispersion become so acute that trade is thrown out of gear and collapses. "The rise in prices contains the seeds of its own decay." Conversely, he suggests, it may be possible to set a limit to the fall in prices if we can determine the minimum value below which the measure of dispersion cannot fall. Internal evidence, says Crump, may enable us to deduce the future trend of the price level. Finally, Lucien March has observed, in the movements of certain French,

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[1] *Business Cycles* (1913), p. 110.

[2] *Journal of the Royal Statistical Society*, Vol. 87, Part II (1924) p. 207.

British and American price series, that the dispersion of price relatives increases as the mean value rises.[1]

The results of the present study show that there is a connection between price dispersion and changes in the price level, but there does not appear to be such a simple and direct relation as that suggested by the authorities quoted. In considering this relationship we may distinguish between price dispersion with reference to a fixed base and dispersion from year to year, measured in terms of link relatives. In respect to fixed base relatives the evidence of Figures 35 and 29 is relevant. Figure 35 shows the actual standard deviations of weighted fixed base relatives, in arithmetic form. The measures for the three periods covered are superimposed in the diagram, to facilitate comparison. The annual values here

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[1] "Les modes de mesure du mouvement général des prix" *Metron*, Vol. I, no. 4 (1921) p. 83.

The data upon which M. March bases his statement possess considerable interest, since they are drawn from different countries and different periods. The following extract summarizes the material bearing upon the present point.

	France		Great Britain		United States	
	1913	Dec. 1919	1913	Dec. 1919	1909	Dec. 1919
Number of articles	55	54	42	38	203	44
Base of relatives	1890–99	1901–10	1890–99	1901–10	1890–99	1901–10
Mean value of relatives	113	502.4	113.5	298	123	258
Standard deviation	22.5	206.3	20.0	111	31.8	126
Coefficient of variation	20	41	18	37	26	49

M. March comments upon these results: "On remarquera d'abord que la dispersion des prix s'accroit quand leur valeur moyenne augmente d'une manière notable. Ainsi l'indice moyen étant égal à 123 aux Etats-Unis en 1909, tandis qu'il ne dépasse pas 113 ou 113.5 en France et en Angleterre en 1913. L'écarte quadratique moyen est sensiblement plus élevé dans le premier pays que dans les deux autres.

De même si l'on compare les deux époques, avant et après la guerre, on constate qu'à l'accroissement des prix correspond un accroissement plus considerable de leur dispersion.

Le coefficient de variation lui-même est, dans tous les cas, à peu près double en 1919 ou 1920 de ce qu'il était avant la guerre."

The fact to which M. March calls attention, that the rise to a higher post-war price level was accompanied by a general increase in dispersion, is not to be controverted. It is unfortunate that the above figures contain no example of dispersion with a declining price level. It would be of interest to have for the recession of 1920-21 measures of dispersion (absolute and relative) of the price series included in March's calculations for 1919.

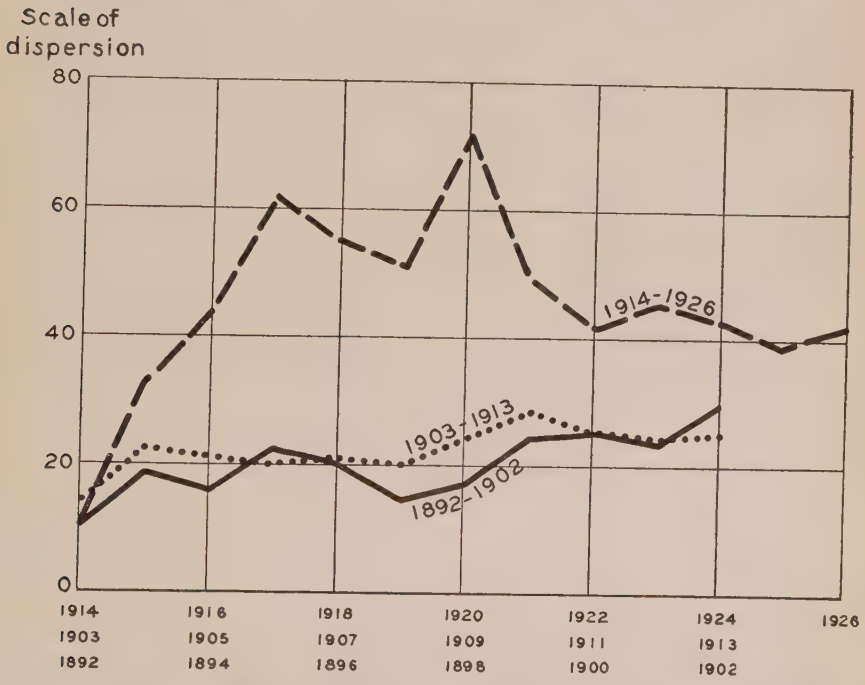
The subsequent discussion in the text will bear upon the general relation between price level and dispersion. In connection with the above figures, attention may be called to one exception to the relationship commented upon by M. March. The December, 1919, average for Great Britain is 298, that for the United States is 258. Both the measure of dispersion and the coefficient of variation are appreciably smaller for Great Britain, the country having the greater change in average prices.

plotted are given in Appendix Table XX, with the corresponding arithmetic averages.

FIGURE 35

Measures of Dispersion Computed from Fixed Base Relatives, by Periods, 1892-1926.

(The measures plotted are the standard deviations of weighted fixed base relatives, in natural form. The bases of the relatives are average prices in the years 1891, 1902 and 1913.)



During the first period (1891-1902) a falling price level to 1896 was marked by a sustained increase in dispersion, broken only by two slight declines in 1894 and 1896. By 1896 the degree of dispersion of relatives on the 1891 base was as great as the dispersion in 1907 of relatives on the 1902 base. During the eleven year periods, 1891-1902 and 1902-1913, the courses of the indexes of dispersion were much the same, though the movements of the price level in these periods were distinctly different. The violent price changes of the third period brought a much greater degree of dispersion. Here again, however, we have results which contradict the theory of a direct and positive relation between changes in the price level and changes in the degree of dispersion. From 1917 to 1919 the price level rose materially; the standard deviation declined ten points. The pronounced drop in the price level between 1920 and 1921 was accompanied by a material decline in the absolute dispersion, a change which accords with the theory mentioned. But from 1921 to 1925, during which the average rose by over 10 points, the standard deviation declined more than 8 points.

These absolute measures of dispersion are misleading, however, and comparison of such measures is hardly justifiable. When the averages of the different distributions differ materially the measures of variation to be compared should be relative rather than absolute. The indexes of dispersion derived from the logarithms of relative prices and expressed as ratios or percentages serve this purpose. These appear in Figure 29. Here the approximate identity of movement during the first two periods is even more apparent than in the preceding chart. The only difference of any moment appears at the ends of the periods. In 1902 the index of dispersion of the 1891 relatives was 17.6 and the geometric mean was 106.0. In 1913 the index of dispersion of the 1902 relatives was 14.1, and the geometric mean was 118.4. Though prices rose considerably more during the second period, the dispersion of relatives at the end of this period was less than at the end of the first period.

The index of dispersion for the third period traces a course even more widely different from that which the theory of a direct relation between price level changes and dispersion would lead one to expect. The great price rise up to and including the year 1919 carried the index of dispersion to exceptional heights only in 1917. From 1914 to 1916 it is no greater than the values of the indexes of dispersion for the corresponding years of the two preceding periods, and in 1918 and 1919 it exceeds the corresponding measures of the earlier periods by amounts which are small in comparison with the price level changes. From 1920 to 1924 the index of dispersion is considerably higher than at corresponding years during the first two periods. From 1920 to 1921, when the price level fell from 225 to 147 (1913 = 100), the index of dispersion increased from 21.6 to 23.5. In 1925, when the geometric mean was 159.4, the index of dispersion stood at 16.3. This figure, for a year 12 years after the base year, is less than that of 1902 (17.6), a year 11 years removed from the base year and having a price level of 106.0 (compared with 100 in the base year, 1891).

There is no evidence here of a consistent relationship between changes in the price level and changes in the degree of dispersion, when measures of dispersion are put on a comparable basis. There is a tendency, which is particularly marked during the several years immediately following the base period, for the dispersion of fixed base relatives to increase as the base year becomes further removed. When the movement happens to coincide with a rising price level, as in the years between 1896 and 1920, there is an apparent connection between rising price level and increasing dispersion.[1] The results of the present study indicate that there is no true relationship here. This is clear even when the dispersion is measured in absolute units. It is somewhat more apparent when the measures of dispersion are expressed in relative terms, which permit accurate comparison.

It is relevant to the present point to note that the highest value of the index of dispersion in the second period was attained in 1907, while in the third period the peak came in 1921. The former was a year of prosperity (judged from annual averages, with which we are here concerned), while the latter was a year of depression. This does not accord with Crump's suggestion that there may be a maximum degree of dispersion which precedes price recession, and a minimum degree of dispersion which forecasts a price rise.

A somewhat more accurate impression of the degree of relationship between shifts in the price level and changes in the degree of dispersion may be obtained by computing the coefficient of correlation between the geometric means of price relatives and corresponding indexes of dispersion. In the case of measures derived from fixed base relatives, first differences (i. e. absolute changes from year to year) are employed in this calculation, in order to eliminate, in part, the effects of the somewhat similar secular movements in the two variables. The coefficient, based upon annual measures for the years 1892 to 1926, has a value of +.057. There is no indication here of a significant relationship.

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[1] The form of this theory which was advanced some years ago by Wesley C. Mitchell is perhaps attributable to the nature of the price relatives with which he dealt. His prices were expressed as relatives on the base, 1890-99 = 100, and covered the years 1890-1910. There is to be expected an increasing concentration around the median as the middle years of the base period are approached, and a decreasing concentration after these middle years are passed. If the base period were a single year, in the middle of the period covered by the relatives, the measure of dispersion would fall to zero in this year. And if this base year happened to be the year when the price level was at bottom, after a period of falling prices and before a period of rising prices, it would appear that there was a close connection between the direction of price change and the degree of dispersion. This connection would be purely fortuitous, due to the choice of a base year. Some such fortuitous element may be present in Dr. Mitchell's evidence, since the years which were given greatest weight in computing the bases of his price relatives came at the end of a long price fall and at the beginning of a sustained rise.

The use of a natural scale on Mitchell's chart tends, also, to suggest a positive relation between changes in the price level and changes in the degree of dispersion. In a later improvement upon this early graph Dr. Mitchell has given a very effective representation of price changes, plotting upon a logarithmic scale deciles derived from annual link relatives. (See *The Making and Using of Index Numbers*, 1921, p. 15.) The relation between price level changes and dispersion is more accurately pictured in this later chart than in the earlier one.

A similar result is secured when the measures of dispersion and price level changes are derived from link relatives. It is not apparent from Figure 31 that there is any consistent relationship between the degree of dispersion of link relatives and the changes in the price level. The sagging prices of 1892-1896 were accompanied by a steady increase in dispersion. The rising prices from 1904 to 1907, leading up to the panic of 1907, were accompanied by a pronounced decline in dispersion, while the price fall in 1908 was marked by an increase in dispersion. From 1920 to 1921 we have the same sharp difference in direction of movement noticed with the fixed base relatives. The coefficient of correlation between the geometric means of link relatives and the corresponding indexes of dispersion, for the 36 years from 1891 to 1926, has a value of +.019. There is no relationship here. High dispersion is equally likely to be found with rising or with falling prices.

We have not, however, exhausted the possibility of discovering a relationship between price level changes and dispersion. It may be that dispersion depends upon the violence of the price change, regardless of direction. Correlating the index of dispersion based on link relatives with the percentage of change in average prices from year to year, taking no account of sign, we secure a coefficient of +.614. We may conclude that in so far as the dispersion of prices is affected by changes in the price level it is the degree, or violence, of the change, not the direction of change, which is important.[1] The coefficient is not high enough, however, to indicate that changes in the price level are the only factors affecting dispersion. There appear to be internal movements, unconnected with changes in the price level, which the index of dispersion enables us to follow.

It may develop that one of the most important and useful features of the index of dispersion, as computed from link relatives and expressed in percentage form, is that its value is largely independent of the actual level of prices. In so far as internal stability is related to the price level, it depends upon the violence of changes in that level, not upon the direction of change. Hence the index of dispersion may be interpreted in terms of a standard which is not a function of the general price level. (The index of dispersion derived from link relatives may have a trend of its own, but that trend does not appear to be related to the trend of average prices.) If the width of the zone of normal dispersion does not depend upon the price level, we have a means of evaluating price stability which is independent of long-term price trends.

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[1] There is reason to think that the degree of relationship varies from period to period. See the note on p. 364.

In 1896 this dispersion index had a value of 9.8, the general price index being then 66 with reference to a 1913 base. In 1926 the dispersion index had a value of 8.9, while the index of wholesale prices had a value of 151, on the 1913 base. The price level was more than twice as high, but the zone of year-to-year dispersion, in percentage form, was narrower. We may, perhaps, look upon 10 per cent as the upper limit to the value of this index of dispersion under usual price conditions.

It does not appear from this survey that indexes of dispersion provide a direct means of forecasting changes in the price level, as was suggested by Crump. They possess value not as forecasting devices, but as means of describing one important aspect of a given price situation. Price stability and the normal functioning of the economic system depend as much upon the maintenance of established internal relations (more exactly, perhaps, upon the avoidance of violent changes in these relations) as upon external equilibrium of the kind associated with a stable price level. The index of dispersion is one important measure of the degree of internal change between specific dates. The excessively high level of the index of dispersion between November, 1920, and September, 1921 (as shown in Figure 34) is perhaps more immediately significant of the troubles which afflicted business at that time than is the falling index of general prices. And that the troubles of the business world since 1921 have been relatively mild ones is evidenced by the minor fluctuations of the dispersion index since that year.

Internal instability of the type which an index of dispersion would reveal may appear as a result of a broken and uneven price advance, as an accompaniment of an irregular price decline, or it might possibly develop with no appreciable change in the price level. The price rise which culminated in 1920 brought wide dispersion, but the ensuing decline brought an even greater scatter of prices. The return to internal equilibrium after the development of such a disturbed condition may come as a result of a decline in the level of prices or may be accomplished by the stabilization of prices at a constant level. The attendant circumstances, considered in connection with the evidence of the dispersion index, may suggest the nature and direction of the change which the restoration of internal equilibrium will involve.

V Price Displacement

It was suggested at an earlier point that our present problem is essentially that of measuring price instability, and a distinction was made between instability of the price level and internal instability. Internal instability was defined, provisionally, as the condition which develops when a set of established price relations is disturbed. One measure of such instability, the index of dispersion, has already been discussed. We advance in the present section to a further consideration of the problem of measuring those internal disturbances in price relations which are of such profound importance in the everyday processes of buying and selling.

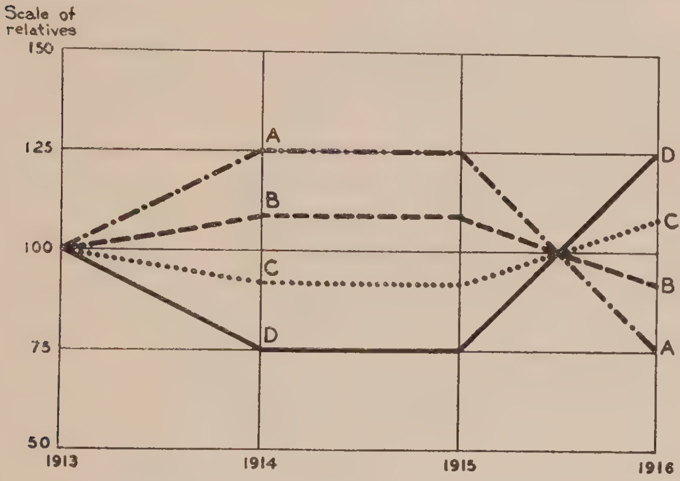
A measure of dispersion, by itself, is inadequate to describe all the alterations in price relations which take place between given dates. This is apparent from a study of Figures 25 and 26, which show the movements of the relative prices of ten commodities from 1913 to 1926. It is clear that the degree of dispersion varies, year by year, and that this dispersion changes the relations between the prices of the individual commodities here presented. But it is also clear that there are other changes in relationship which elude measurement by the index of dispersion. The lines representing fixed base relatives (Figure 25) are constantly crossing and recrossing. The dispersion of relative prices in two years may be approximately the same (a condition exemplified by unweighted relatives, on the 1913 base, in 1919 and 1924), but the commodities may stand in quite a different order. This shifting of relative position may affect buying and selling relationships just as much as would a change in the degree of dispersion.

The nature of this internal shifting, which is here called *price displacement,* may be made clearer by a hypothetical example. There are sketched in Figure 36 the movements of the relative prices of four commodities, represented by the letters A, B, C and D, from 1913 to 1916. Prices in 1913 furnish the bases of the relatives. If the movements in the prices of these four commodities are to be followed by means of the average alone, no change will be noted between the four years covered. The average is 100 throughout.

FIGURE 36

AN ILLUSTRATION OF PRICE DISPLACEMENT.

Changes in the Relative Prices of Four Commodities from 1913 to 1916.



Moreover, the dispersion of prices with reference to the base year, 1913, is the same in 1914, 1915 and 1916. Yet between 1915 and 1916 a change of obvious economic importance has taken place. This is the complete reversal in the price relations of the four commodities. Article A which was in 1915 highest, relatively, is lowest in 1916, and the positions of the other articles have been correspondingly changed. A measure of such internal displacement is needed, as a supplement to the usual index of prices and the measure of dispersion, if price changes are to be accurately portrayed.

1. THE MEASUREMENT OF PRICE DISPLACEMENT

In seeking a measure of the shifting or internal displacement of prices from year to year (or month to month) trials were made with several different devices. Because of the dominant influence of one or two exceptional cases, the coefficient of correlation based upon the actual price relatives did not seem to be appropriate to the present purpose. This difficulty could be overcome, in part, by measuring the correlation between logarithms of price relatives. This was done in certain experiments. The most satisfactory results, however, were secured from the coefficient of rank correlation, based upon the squares of the differences in rank. The formula for its computation is

$$\rho = 1 - \frac{6\Sigma d^2}{N(N^2-1)}$$

where d represents a difference in rank. It is computed quite readily by arranging the relative prices in order of rank in the two years to be compared, determining the differences in the rankings of individual commodities in these years, and applying the above formula. Pearson has shown that if the original data upon which the rankings are based are distributed normally, r, computed directly from the data, will differ slightly from ρ, computed from the ranks. In the present case, however, we are not using ρ as an approximation to r, but as a measure significant in itself. The absolute value of ρ at a given time has no particular significance for us; our interest lies in a comparison of values at different times. For this purpose the coefficient of rank correlation seems to be an adequate and reliable measure of shifting price relations.

The maximum value of the coefficient of rank correlation is +1, its minimum value −1. The data shown graphically in Figure 36 will serve as an illustration.

Commodity	Rank, 1914	Rank, 1915	Rank, 1916
A	1	1	4
B	2	2	3
C	3	3	2
D	4	4	1

Under these conditions the correlation between the rankings in 1914 and 1915 is +1, while the correlation between the rankings in 1915 and 1916 is −1. For any degree of shifting less revolutionary than a complete reversal the coefficient would be greater (algebraically) than −1 and, unless the rankings were identical in the two years compared, less than +1.

The coefficient of rank correlation may be looked upon as a measure of price disturbance, since its value depends upon the amount of displacement taking place within a given time interval. Used in conjunction with a measure of changes in the general price level and a measure of dispersion, it serves to give a fairly complete account of general changes in prices and in price relations between given dates.

For practical use as a measure of price disturbance it is desirable to present this measure of correlation in a slightly modified form. The values of ρ, as a measure of price displacement, are found to fall, in general, between +1 and 0. As the value falls toward zero it indicates increasing price disturbance. This may be a bit confusing, as in index numbers of the usual type rising values represent increasing change. Accordingly, this measure is used in the form $1-\rho$. A value of zero for this index will mean no price disturbance, and rising values will mean increasing displacement. The maximum value, which would represent an exact reversal of all price relations, is $1-(-1)$, or 2.

Several special problems arise in connection with the index of price displacement. Its value depends, of course, upon the base of the price relative used, as well as upon the particular years or months compared. When fixed base relatives are employed the year-to-year shifting of price relatives tends to decrease as the base period becomes more remote, because of the increase in dispersion which is so marked during the several years immediately following the base year. Yet link relatives cannot be employed, for it is shifts of position with reference to a *common base* which we seek to measure. We may, as an alternative, employ a moving base period, each year serving as a base for the relatives of the first and second years succeeding. Thus we would correlate 1914 and 1915 relatives on the 1913 base, 1915 and 1916 relatives on the 1914 base, and so on. By this means we may avoid the bias due to increasing dispersion and secure the desired measure of displacement from year to year (or month to month) with reference to a common base. Index numbers of displacement have been computed from both fixed base and moving base relatives.

2. The Displacement of Fixed Base Relatives with Reference to a Constant Criterion

The three sets of fixed base relatives described in earlier sections (covering the periods 1891 to 1902, on the 1891 base, 1902 to 1913, on the 1902 base, and 1913 to 1926, on the 1913 base) have been utilized in the measurement of price shifting. The relatives for the first and second periods have been extended to 1903 and 1914, respectively, for the purposes of the present study. In the first analysis a constant criterion has been employed in each period, this criterion being the ranking of relatives in the first year after the base year. That is, the relative positions of the various commodities in each year of the first period have been compared with their relative positions in 1892. For the second period the ranking in 1903 has served as criterion, and for the third period the ranking in 1914 has been used. No particular significance attaches to the choice of these years. The immediate requirement is that a constant yard-stick shall be used in measuring the shifts from year to year. The bearing of the criterion upon the interpretation of the results is discussed at a later point.

The indexes of displacement are given in the following table, and are plotted in Figure 37. They are based upon the prices of 216 commodities throughout, except for the years 1925 and 1926, for which 213 and 212 series were used, respectively.

TABLE 104

Measures of Price Displacement, 1893-1926

Displacement of Fixed Base Relatives, by Periods, with Reference to a Constant Criterion in each Period.

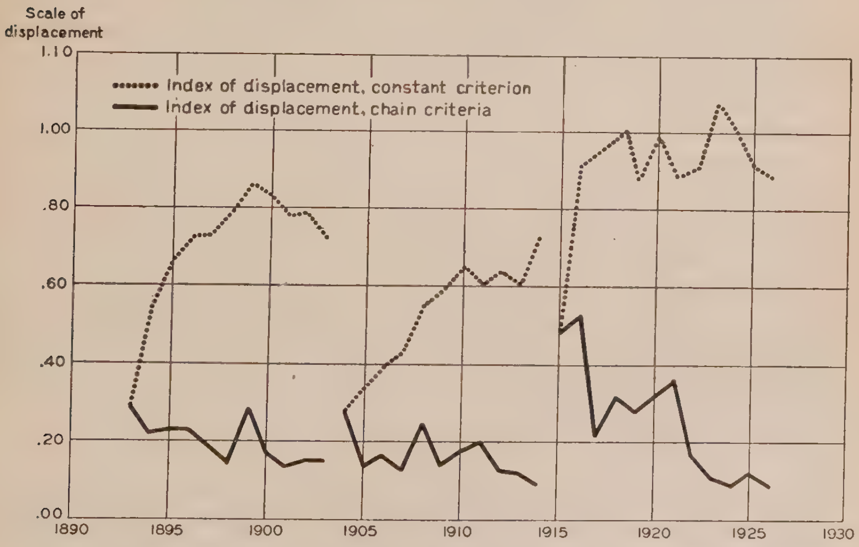
(1) Years compared	(2) Base of relatives	(3) Index of displacement
1893–1892	1891	.28
1894–1892	1891	.55
1895–1892	1891	.67
1896–1892	1891	.73
1897–1892	1891	.73
1898–1892	1891	.80
1899–1892	1891	.86
1900–1892	1891	.83
1901–1892	1891	.78
1902–1892	1891	.79
1903–1892	1891	.73
1904–1903	1902	.28
1905–1903	1902	.34
1906–1903	1902	.40
1907–1903	1902	.43
1908–1903	1902	.56
1909–1903	1902	.59
1910–1903	1902	.65
1911–1903	1902	.61
1912–1903	1902	.64
1913–1903	1902	.61
1914–1903	1902	.74
1915–1914	1913	.48
1916–1914	1913	.92
1917–1914	1913	.95
1918–1914	1913	1.00
1919–1914	1913	.87
1920–1914	1913	.99
1921–1914	1913	.89
1922–1914	1913	.91
1923–1914	1913	1.07
1924–1914	1913	1.01
1925–1914	1913	.92
1926–1914	1913	.89

In studying these values the precise significance of each figure must be borne in mind. We may take the first entry in the table as an example. This measures the degree of price shifting between 1892 and 1893. In 1892 the relatives, on the 1891 base, stood in a certain position, when arranged in order of magnitude. At the top of the list was jute, for which the relative was 129.7. At the bottom were potatoes, with a relative of 58.9. If in 1893 the ranking of the relatives on the 1891 base had been the same throughout as in 1892 the index of displacement would have a value of zero. But there had been some changes. Mess pork was now at the top, with a relative of 162.3, and rye was lowest in the list, with a relative of 58.8. The index of displacement takes account, of course, not only of the shift in the top and bottom values, but of all the changes in position of the relative prices of the 216 articles included. The value of .28 indicates a material degree of shifting between 1892 and 1893.

FIGURE 37

INDEXES OF PRICE DISPLACEMENT, 1893-1926.

Measures of the Degree of Shifting of Fixed Base Relatives, by Periods, with Reference to a Constant Criterion and to Chain Criteria in Each Period.



The degree of departure from the 1892 relations increased, with a pause between 1896 and 1897, to 1899, for which year the displacement is measured by an index of .86. The degree of displacement declined slightly thereafter, the index having a value of .73 when the period ended in 1903.[1]

In the second period, for which relatives on the 1902 base have been employed, the degree of departure from the 1903 situation increases to 1914, with slight downward movements in 1911 and 1913. The measure of the degree of displacement during the 11 year period from 1903 to 1914 has a value of .74, as compared with .73 for the 11 year period from 1892 to 1903. Approximately the same degree of change was experienced over each of these periods, judging from the terminal values of the index, although more radical changes occurred within the first period.

The developments from 1915 to 1926 stand in rather sharp contrast to those of the periods just described. The degree of shifting in position of 1913 base relatives between 1914 and 1915 is measured by an index of .48. The displacement during the one year period from 1914 to 1915 was greater than that which occurred over the four year period from 1903 to 1907. By 1916 the departure from 1914 relationships, measured by an index of .92, was greater than that which took place over the entire 11 year period from 1892 to 1903, or over the period from 1903 to 1914. From 1916 to 1926 the index oscillates in the neighborhood of this value. It reaches noticeably higher values (.99 or above) in 1918, 1920, 1923 and 1924, but by far the sharpest break took place in the two years from 1914 to 1916. The high value of 1918 was followed, in 1919, by something of a swing back to 1914 relationships, and the years 1921, 1925 and 1926 were marked by similar changes. Future tendencies in this direction will be followed with interest. In 1926 the index of displacement had a value of .89, slightly below that recorded for 1916 and equal to that for 1921.

In interpreting these figures it will be recalled that a value of 1.00 for the index of displacement represents a complete destruction of the set of price relations prevailing at the date represented by the criterion, while a value of 2.00 would indicate an exact reversal of the rankings throughout, the building up a new set of price relations representing the precise opposite of those prevailing at the earlier date. By "a set of price relations," as that phrase is used in the discussion of price displacement, is meant the particular system defined by the ranking of a given group of price relatives at a given date. Thus the ranking in 1914 of relatives on the 1913 base defines one set of price relations, while the ranking in 1914 of relatives on the 1902 base would define a quite different set of relations. These different sets of relations vary widely in significance and, accordingly, the index of displacement is always to be interpreted in terms of the particular criteria and the particular displacements to which it relates. When it is said that "a set of price relations has been destroyed," this does not mean that all ties between elements in the price system have been severed, but merely that the set of relations defined by a particular ranking of price relatives has been destroyed. The significance of such a "destruction" depends, obviously, on the significance of the relations defined by the ranking in question.

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[1] In another computation the degree of displacement between 1892 and 1914 has been measured, employing relatives on the 1891 base. It is of interest to note that in 1914 the relatives on the 1891 base showed approximately the same degree of departure from the 1892 situation as they did in 1903. The value of the index of displacement was .74. (This figure is not to be confused with the similar value, measuring the relation between 1914 and 1903, derived from relatives on the 1902 base.) There had, of course, been considerable shifting between 1903 and 1914, but in relation to the 1892 situation the two years represented about the same degree of change.

The measures of displacement relating to the last period show that by 1916 the set of price relations prevailing in 1914 (as measured by relatives on the 1913 base) had been almost completely destroyed (the index had a value of .92), and that by 1918 no vestige of these relations survived (the value of the index was 1.00 in 1918). Between 1918 and 1923 there were minor swings, culminating in a maximum degree of displacement in 1923. Since 1923 there has been a slight tendency to return to the 1914 relations, but the degree of departure from pre-war relations, as defined by the present criterion, remains considerable. There is but a remote connection between the ranking of 1913 relatives in 1914 and the ranking of these relatives in 1926.

This is perhaps to be expected. As was pointed out at an earlier point, no particular significance may be attached to the ranking of 1913 base relatives in 1914. As a constant yard-stick, with which rankings at various other dates may be compared, it is useful, but it cannot be accepted as representing a very significant set of pre-war price relations. Changes in individual prices from one year to the next must reflect, in large part, the play of accidental and temporary forces, and only to a small extent the operation of those relatively permanent forces which are of chief importance in forming a "system" of price relations. If the index of displacement is to be used to register shifts in a well-established set of price relations, the ranking of relatives which is to serve as the basis of comparison (the criterion) should be that prevailing at a period further removed from the base period.

For the purpose of measuring such shifts use has been made of relatives on the 1891 base, which have been carried forward through 1926. The commodities represented are 195 in number (except for the years 1918 and 1925, for which there were 194, and 1926, for which there were 193 quotations).[1] The ranking of these relatives in 1914 has been used as the standard of comparison throughout. By 1914 the relatives on the 1891 base may be assumed to have reached fairly stable positions in relation to each other. The differences between them would reflect to some extent temporary dislocations due to current cyclical and accidental movements, but the chief cause for differences between relatives on a base 23 years distant would be variations in underlying trends. Long-time changes in costs of production, enduring shifts in consumer demand, changes in styles and habits—all these would be reflected in the ranking of relatives on a base so many years removed. Partly because of the deep-seated character of these changes and the stability of the resulting set of price relations, partly because of the wide dispersion of the relatives after the lapse of 23 years, less radical shifts are to be expected than under the conditions previously studied, and greater significance is to be attached to given measures of displacement. These measures are shown in the following table. They are plotted in Figure 38.

TABLE 105

MEASURES OF PRICE DISPLACEMENT, 1915-1926

Displacement of Relatives on the 1891 Base, with Reference to the Ranking of these Relatives in 1914.

Years compared	Index of displacement	Years compared	Index of displacement
1915–1914	.17	1921–1914	.43
1916–1914	.28	1922–1914	.41
1917–1914	.40	1923–1914	.48
1918–1914	.36	1924–1914	.42
1919–1914	.27	1925–1914	.33
1920–1914	.44	1926–1914	.33

It is first to be noted that these indexes of displacement are distinctly lower in value than the series in Table 104 measuring the shifts in relationship after 1914. The highest value is .48, for 1923, as compared with 1.07, the figure for 1923 when relatives on the

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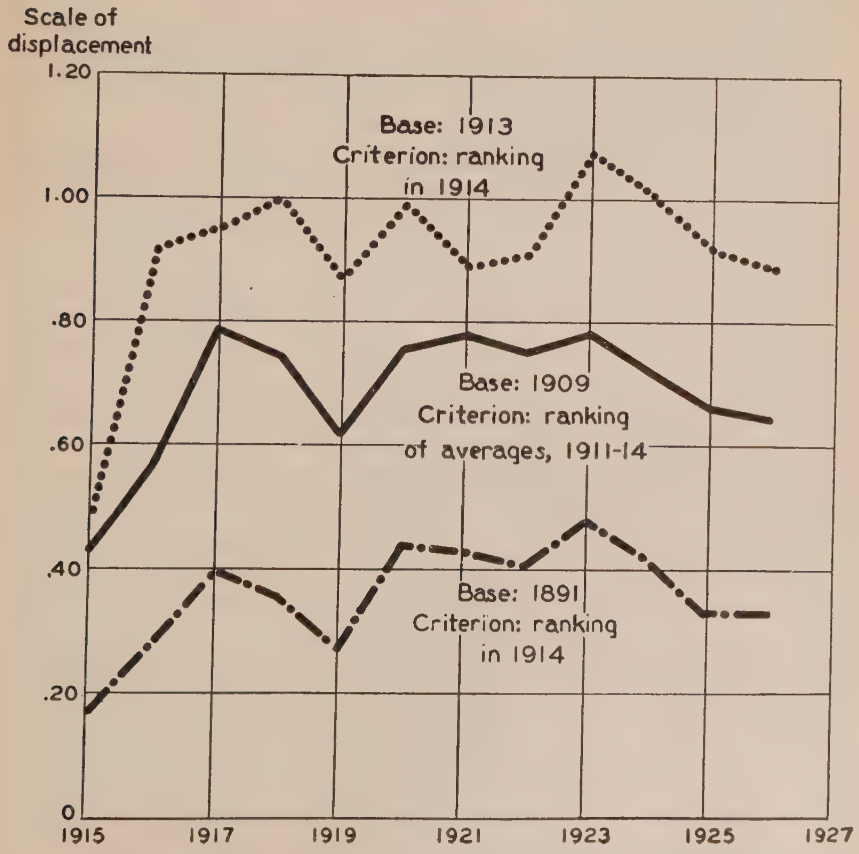
[1] These are the commodities employed in computing the various measures of price level changes and price dispersion for the years from 1891 to 1902. See Appendix Table I.

1913 base were employed. If we think of the 1914 ranking of 1913 relatives as representing an established system of pre-war price relationships, we would say that this system was completely destroyed during the price revolution which began in 1915. If we accept the 1914 ranking of relatives on the 1891 base as representing pre-war price relationships, the figures in Table 105 would indicate that although these relationships were materially altered by war and post-war changes, they were by no means destroyed. The latter is undoubtedly a more valid statement than the former, since the second set of relationships is more significant than the first.

FIGURE 38

Indexes of Price Displacement, 1915-1926.

Measures of the Degree of Shifting of Three Series of Fixed Base Relatives with Reference to a Constant Criterion for Each Series.



The changes in the index of displacement recorded in Table 105 are of considerable interest. The transition to a war economy brought a definite swing away from the 1914 ranking. This movement reached a first peak in 1917. In 1918 there was a minor movement back toward the 1914 relationships, a movement which was much more pronounced in 1919. The first effect of the end of the war was to initiate a return to pre-war price relations. (The same tendency is apparent in the measures given in Table 104. It is possible that this movement is in part a reflection of federal price regulation from 1917 to 1919.) Between 1920 and 1923 there was another clear swing away from the relationships of pre-war days. The indexes in Tables 104 and 105 agree in showing 1923 to be farthest removed from 1914 in respect to commodity price relations. Between 1924 and 1926 there was a swing back toward 1914 price relations, a swing which is reflected in the movements of both index numbers.

A third set of measures of the displacement of prices during the war and post-war years is presented in Table 106. The significance of any such measures depends, as has been pointed out, on the adequacy of the criterion which is assumed to define a system of established price relations. Neither of the criteria previously employed as representative of pre-war relations is altogether satisfactory. That based upon the ranking of relatives one year after the base year gives too much weight to accidental factors of no permanent significance. On the other hand, 1891 is perhaps too far removed from the year serving as criterion. For by 1914 the dispersion of relatives on the 1891 base was so great that any change in ranking required a considerable movement of prices. In computing the present measures of displacement, relatives on the 1909 base have been employed, and in arranging the ranking to serve as criterion the values of these relatives in the years 1911 to 1914 have been averaged. The ranking of averages of relatives for a period of four years should give a set of price relationships less affected by temporary shifts than would the ranking in any one year and, by the use of a base two to five years removed from the years entering into the criterion, time is given for the development of a fairly significant "system." The present criterion is probably a better representative of pre-war price relations than is either of those previously employed. This index is plotted, with the two previously discussed, in Figure 38.

TABLE 106

MEASURES OF PRICE DISPLACEMENT, 1915-1926

Displacement of Relatives on the 1909 Base, with Reference to the Ranking of Averages of these Relatives during the Years 1911-1914

Year compared with pre-war criterion	Index of displacement[1]
1915	.43
1916	.57
1917	.79
1918	.75
1919	.62
1920	.76
1921	.78
1922	.75
1923	.78
1924	.72
1925	.66
1926	.64

[1] This index is computed from 216 price series, except for the years 1925 and 1926. In these years 213 and 212 series, respectively, were used.

Although these indexes differ materially in value there is a significant correspondence between them in respect to the general course of their movements during the years from 1915 to 1926. The agreement in the direction and degree of the annual movements of the indexes based upon 1891 and upon 1909 relatives is particularly marked. The index derived from 1909 relatives differs from the others in that it shows a degree of displacement in 1917 slightly greater than in 1923. The other two reach their highest values in 1923.

The differences between the absolute values of the three indexes are of considerable interest, for these absolute values indicate the degree to which the set of pre-war relationships defined by each of the three criteria survived the disturbances of the war and post-war years. As compared with maximum values of 1.07 (in 1923) for the index derived from 1913 relatives, and .48 (also in 1923) for the index based upon 1891 relatives, the index secured from the 1909 relatives reaches maximum values of .79 in 1917 and .78 in 1923. The value of .48 represents, as has been pointed out, a substantial modification in the given set of price relations, .79 represents a more profound alteration, while 1.07 indicates the complete disappearance of the set of relations which serves as criterion. It is to be expected that the index secured from 1909 relatives should fall between the two other indexes. The set of relations defined by the ranking of pre-war averages of relatives on the 1909 base did not have roots as deep as did the set derived from 1891 relatives, but was much more firmly established than the system defined by the 1914 ranking of relatives on the 1913 base. The varying changes which the price revolution wrought in these three sets of relations correspond to these differences, the most deeply rooted system experiencing the smallest degree of disturbance.

The 1926 situation is summarily described by the three final values of these indexes, .89 in respect to the system of price relations which was the resultant of changes from 1913 to 1914, .64 in respect to the system which developed between 1909 and 1914, and .33 in respect to the system which developed between 1891 and 1914. Only a vestige of the first set of relations remained, the second was fundamentally modified, while the third, although altered materially, endured in its main features.

The general correspondence between the year-to-year movements of these three indexes of displacement, and the consistent and logical differences between their respective annual values give added significance to the story they tell.

3. The Displacement of Fixed Base Relatives with Reference to the Preceding Year as Criterion

The indexes discussed above have measured the degree of shifting of price relatives with reference to a fixed standard in each period. Interest attaches also to the year-to-year shifts in price relations. These shifts may be measured by comparing the rankings of fixed base relatives in successive years. Measures of displacement derived from these rankings are given in the following table, and are plotted, with certain of the measures considered above, in Figure 37.

In interpreting these results we face a difficulty because of the relation of dispersion to displacement, when the displacement measure is computed by the method employed above. As the individual relatives on a fixed base become more widely dispersed, a change in ranking is brought about only by relatively greater changes in prices. When the criterion is a constant one, as in the first set of displacement measures presented, this factor of increasing dispersion tends to bring about a fairly stable value of the displacement index. When the criterion in each case is the ranking of fixed base

TABLE 107

MEASURES OF PRICE DISPLACEMENT, 1893-1926

Displacement of Fixed Base Relatives from Year to Year

(1) Years compared	(2) Base of relatives	(3) Index of displacement
1893–1892	1891	.28
1894–1893	1891	.22
1895–1894	1891	.23
1896–1895	1891	.23
1897–1896	1891	.19
1898–1897	1891	.15
1899–1898	1891	.28
1900–1899	1891	.17
1901–1900	1891	.14
1902–1901	1891	.15
1903–1902	1891	.15
1904–1903	1902	.28
1905–1904	1902	.14
1906–1905	1902	.16
1907–1906	1902	.13
1908–1907	1902	.25
1909–1908	1902	.14
1910–1909	1902	.18
1911–1910	1902	.20
1912–1911	1902	.13
1913–1912	1902	.12
1914–1913	1902	.09
1915–1914	1913	.48
1916–1915	1913	.52
1917–1916	1913	.22
1918–1917	1913	.32
1919–1918	1913	.28
1920–1919	1913	.32
1921–1920	1913	.36
1922–1921	1913	.17
1923–1922	1913	.11
1924–1923	1913	.09
1925–1924	1913	.13
1926–1925	1913	.09

relatives in the preceding year, the factor of increasing dispersion tends constantly to lower the index of displacement. Thus, so long as there is an upward secular tendency in the dispersion of fixed base relatives, there will be a downward trend in a measure of displacement involving the year-to-year comparison of fixed base relatives. Such a movement is apparent in each of the three periods covered by the index of displacement at present under discussion. This tendency must be recognized, but it does not invalidate all comparison of these measures.

During the first period the index of displacement declined regularly, as would be expected because of the increase in dispersion, but there was a single marked break in this decline in 1899. The index of displacement between 1898 and 1899 had a value of .28. If we except the first years of the two periods, this indicates a greater degree of shifting than took place in any twelve-month interval between 1893 and 1914. This substantiates other evidence that 1899 was a year of marked internal price disturbance. In 1908 the index, with a value of .25, stood next highest (again excepting the first year in each of the first two periods; because of the smallness of the dispersion of fixed base relatives during the first two years after the base year, a relatively high index of displacement is to be expected in these years).

The 12 years from 1915 to 1926 may be broken into three fairly distinct divisions. The first, which includes the years 1915 and 1916, covers the period of sharp and violent transition to a war-time economy. During these years the present index of displacement attained the highest value recorded during the 34 years of this history. The index had a value of .48 in 1915 and .52 in 1916. The tremendous internal revolution in the price structure is perhaps more clearly indicated by these figures for 1915 and 1916 than by any other price measure we have employed. The high values of the index are doubly significant because of the very considerable dispersion of the 1913 base relatives in these years.

The second division, extending from 1917 to 1921, covers the last years of the war and the years of transition from war-time organization to a peace-time economy. By 1917 something approaching war-time stability had been attained. The index of displacement fell from .52 in 1916 to .22 in 1917. While this latter figure was relatively high compared with pre-war figures, it was the lowest value recorded between 1915 and 1921. From 1917 to 1921 the index of displacement moved upward, with a slight decline in 1919. This upward movement occurred during a period marked by approximate stability of the index of dispersion (unweighted). The considerable increase in the degree of displacement in 1920 and 1921 reflects the price readjustments accompanying liquidation and the building up of a set of price relationships adapted to peace-time conditions. The severity of this readjustment is attested by the relatively high values of the present index in 1920 and 1921 (values of .32 and .36). These were higher than any values recorded in pre-war years, a fact which is the more significant because the dispersion of fixed base relatives during these years was greater than during any period prior to the war.

The third division includes the years from 1922 to 1926. This is a period of stability, during which the index of displacement ranged between .09 and .17. In the one year from 1921 to 1922 the value of the index was reduced by more than one-half, falling from .36 to .17. It was below this latter figure in all the years after 1922. By that year the violent year-to-year shifts in price relations which had characterized the preceding seven years were over.

The nature of this condition of stability which has prevailed during the last several years calls for some consideration. That its establishment involved a considerable break with the preceding years is evidenced by the high values of the index of year-to-year change in 1920 and 1921. Even more complete was the departure from war-time relations. This has been measured by means of a separate index, based upon the ranking of price relatives (on the 1913 base) in 1917 and in 1926. This index of displacement, computed from 212 relatives, has a value of 1.07. This means that by 1926 no vestige remained of the set of price relations (represented by the ranking of relatives on the 1913 base) which prevailed in 1917. In view of the magnitude of the dispersion of 1913 relatives in both the years compared, this value of the index of displacement represents a fundamental change.

It has been pointed out that this recent condition of stability has been marked by a tendency to return to the system of price relations which prevailed before the war, a tendency which is apparent in respect to each of the three criteria of pre-war price relations. This is a significant movement, and it will be a matter of considerable interest to determine whether it continues during the next several years.

4. THE DISPLACEMENT OF TWO-YEAR LINK RELATIVES WITH REFERENCE TO THE PRECEDING YEAR AS CRITERION

In order to eliminate the effect of the time factor upon the index of displacement, a measure based upon one- and two-year link relatives has been constructed. The values secured are given in the following table, and are plotted in Figure 39.[1]

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[1] As in the preceding calculations these measures are based upon the prices of 216 commodities in each year, except 1925, when 213 commodities were used, and 1926, when 212 price series were available.

TABLE 108

MEASURES OF PRICE DISPLACEMENT, 1893-1926

Displacement of Two-Year Link Relatives, with Reference to the Ranking of Link Relatives in the Preceding Year.

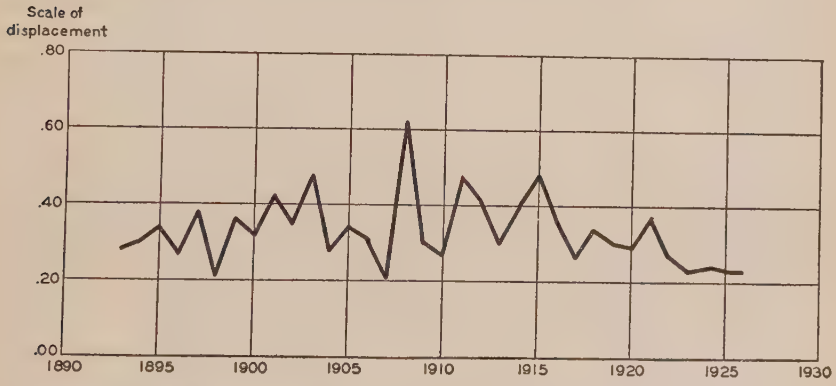
(1) Years compared	(2) Base of relatives	(3) Index of displacement
1893–1892	1891	.28
1894–1893	1892	.30
1895–1894	1893	.34
1896–1895	1894	.27
1897–1896	1895	.38
1898–1897	1896	.21
1899–1898	1897	.36
1900–1899	1898	.32
1901–1900	1899	.42
1902–1901	1900	.35
1903–1902	1901	.47
1904–1903	1902	.28
1905–1904	1903	.34
1906–1905	1904	.31
1907–1906	1905	.21
1908–1907	1906	.62
1909–1908	1907	.30
1910–1909	1908	.27
1911–1910	1909	.47
1912–1911	1910	.41
1913–1912	1911	.30
1914–1913	1912	.40
1915–1914	1913	.48
1916–1915	1914	.36
1917–1916	1915	.26
1918–1917	1916	.34
1919–1918	1917	.30
1920–1919	1918	.29
1921–1920	1919	.37
1922–1921	1920	.27
1923–1922	1921	.23
1924–1923	1922	.24
1925–1924	1923	.23
1926–1925	1924	.23

The interpretation of this index is not as simple as in the two cases preceding. The index of displacement for every year, it must be remembered, is affected by prices in three years—the year which is used as the base of the relatives, the year which serves as a criterion in comparing the rankings of relatives, and the year to which the measures specifically relate. (The latter is the *given* year, in index number terminology.) In computing the indexes of displacement given in Tables 104, 105 and 106 the relatives employed were all on the same base, and the criterion was constant for all the comparisons relating to a given period. Changes in the values of the index from year to year reflected changes in the ranking of relatives in the *given* years. There was only one variable to follow. This procedure was modified somewhat in computing the indexes in Table 107. Here the base of the relatives was the same throughout each period, but both criterion and given year changed from year to year. The interpretation of the values remains fairly simple, however, for the derived measures indicate the violence of the shifts in position between successive years. The index given in Table 108 involves three variables, for the base of the relatives, criterion and given year vary each time. Thus the value of the index in 1908 is affected by the prices of 216 commodities in three different years, 1906, 1907 and 1908, while the value of the index in 1912 is affected by prices in 1910, 1911 and 1912. The values for 1908 and for 1912 have no factor in common. Yet, as a means of measuring the intensity of year-to-year price disturbances, these measures possess significance.[1]

FIGURE 39

INDEX OF PRICE DISPLACEMENT, 1893-1926.

Measures of the Degree of Shifting of Two-Year Link Relatives, with Reference to the Ranking of Link Relatives in the Preceding Year.



The index of displacement based upon one-year and two-year link relatives serves as a measure of the violence of price changes with reference to the immediate past. Perhaps it is most significant to look upon it as a measure of the degree to which tendencies prevailing in a given year represent a continuation of those prevailing during the preceding year. The lower the index of displacement the more uniform is the internal movement between successive years; the higher the index, the greater is the check to the tendencies prevailing in the year preceding.

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[1] The differences between this index and those showing violence of year-to-year shifts in fixed base relatives (which are plotted in Figure 37) show how important the choice of a base is. Both indexes measure the displacement of prices between a given year and the year preceding. The differences between the two sets of measures are attributable entirely to differences in the bases of the relatives.

The general course of the index differs materially from that of the one discussed previously. From 1893 to 1903 there is a general upward movement in the value of the index. There was a major check to this increase in 1898, with minor checks in 1896, 1900 and 1902. The general upward movement may be interpreted to mean that during most of this period there were conflicting tendencies in the movements of prices. The tide of business was not running consistently in one direction. These shifts in price tendencies were most marked between 1896 and 1897, between 1900 and 1901, and between 1902 and 1903. Between 1897 and 1898, if one may judge from this index, the tide was moving uniformly in a single direction, with only minor disturbances.

After 1903 there came a period of four years marked by a relatively unbroken flow in a single direction. Apart from a very slight check in 1905 the index moved downward, reaching a very low value in 1907. During the years of prosperity preceding the crisis of 1907 there were few discordant elements. Between 1906 and 1907 the tide was at its smoothest. This remarkable stability is significant, because of its bearing upon the theory that greater and greater price maladjustments develop during revival and prosperity, these culminating in a crisis which brings about a more stable condition. The present measures of price displacement do not indicate that maladjustments with reference to the immediate past develop during prosperity. (Since the indexes now under discussion relate only to year-to-year shifts, they would throw no light upon possible maladjustments with reference to an earlier situation.)

The tendencies which prevailed between 1906 and 1907 (which represented, apparently, a continuation of those prevailing after 1903) were sharply reversed in 1908. In this year the index of displacement based on link relatives reached a much higher value than in any other year during the period 1893-1926. This is a surprising result, as one would have expected much greater disturbances during the war and post-war years. Presumably it is explained by the nature of the index, which measures disturbances with reference to an immediate past. The shift in price relations between 1906 and 1907 was very slight, but 1908 brought a sharp, swift break in established relations. During the price changes of the war years and of the period of liquidation after the war pronounced changes in price relations took place, as is evidenced by the other measures of displacement, but there was no such sharp and sudden break with the past as in 1908.[1]

After 1908 the index of displacement remains low for two years, is fairly high in 1911 and 1912, falls in 1913, to rise again in 1914 and 1915. The value for 1915, which is the second highest for the entire period, gives evidence of a sharp dislocation. During the years 1916 and 1917 a decline in the measures of displacement indicates a continuation of those tendencies which prevailed in 1915. The year 1918 brought a somewhat higher value again, but the check to 1917 tendencies was not pronounced. Relatively low values were obtained for 1919 and 1920. There was no sharp break with the immediate past in this period. The year 1921 marks a slight advance, but one which is smaller than might have been expected. The explanation is, perhaps, that the readjustment of price relations which the end of the war necessitated was in process during all the years from 1918 to 1921, though the external manifestations were most marked in the last year. Such gradual changes may keep the index on a fairly high level, but would not give rise to such a high value as that of the year 1908. From 1922 to 1926 the values of the index were relatively low. Only in two earlier years (1898 and 1907) were values recorded lower than those of the years 1923 to 1926. There is a suggestion here that during this period, as in the years from 1904 to 1907, the tide of business was moving steadily in one direction, with no serious checks or dislocations.

Each of the three annual indexes of displacement measures a somewhat different type of price change, and the nature of each must be borne in mind in interpreting it. Taken together they give a comprehensive account of the shifts in price relations which occur over a given period of time.

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[1] The fact that average annual prices are employed in these calculations detracts somewhat from the faithfulness of the picture which the index gives. An average for any year may measure the net result of two opposite movements. Thus an average for 1920 represents the net value of the upward movement during the first part of the year and the downward movement in the last part. The years 1920 and 1921 do not, perhaps, stand in as sharp opposition to each other as do 1907 and 1908. In 1907 the break in commodity prices came well toward the end of the year, and the average for the year as a whole represents the forces of prosperity.

5. Monthly Measures of Price Displacement

In following the shifting of prices from month to month, measures corresponding to all those employed in handling annual prices might be utilized. In the present study use has been made only of fixed base relatives, and the analysis has been confined to the period 1920-1926. Changes in the ranking of price relatives (on the 1913 base) from month to month and over a twelve-month period have been measured. The indexes of displacement are based upon the prices of 100 commodities at wholesale.[1]

The measures of month-to-month displacement appear in the following table. They are plotted in Figure 40.

TABLE 109

Monthly Measures of Price Displacement, 1920-1926

Displacement of Fixed Base Relatives, with Reference to Preceding Month as Criterion.

(Base of relatives: 1913)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Months compared	Index of displacement						
	1920	1921	1922	1923	1924	1925	1926
Jan.–Dec.		.038	.032	.014	.016	.028	.041
Feb.–Jan.	.021	.038	.017	.013	.019	.025	.015
Mar.–Feb.	.022	.022	.021	.011	.018	.034	.042
Apr.–Mar.	.044	.024	.019	.017	.015	.021	.010
May–Apr.	.018	.035	.031	.020	.014	.024	.024
June–May	.018	.015	.019	.009	.021	.033	.015
July–June	.016	.031	.015	.014	.021	.016	.016
Aug.–July	.025	.025	.048	.008	.018	.022	.009
Sept.–Aug.	.045	.034	.028	.025	.026	.021	.018
Oct.–Sept.	.044	.031	.011	.025	.019	.043	.027
Nov.–Oct.	.048	.030	.026	.025	.024	.016	.023
Dec.–Nov.	.038	.007	.027	.014	.018	.063	.020

The course of this index is in many respects like that of the monthly index of dispersion. Though the major movements of the period covered are fairly clear, there is great irregularity in the month-to-month movements. This irregularity is doubtless accounted for in part by the smallness of the sample. There is reason to think, however, that this irregularity represents an inherent characteristic of the data. The various measures of internal change which have been computed on a monthly basis indicate that such alterations in price relationships, even those which accompany major price movements, are sporadic and irregular.

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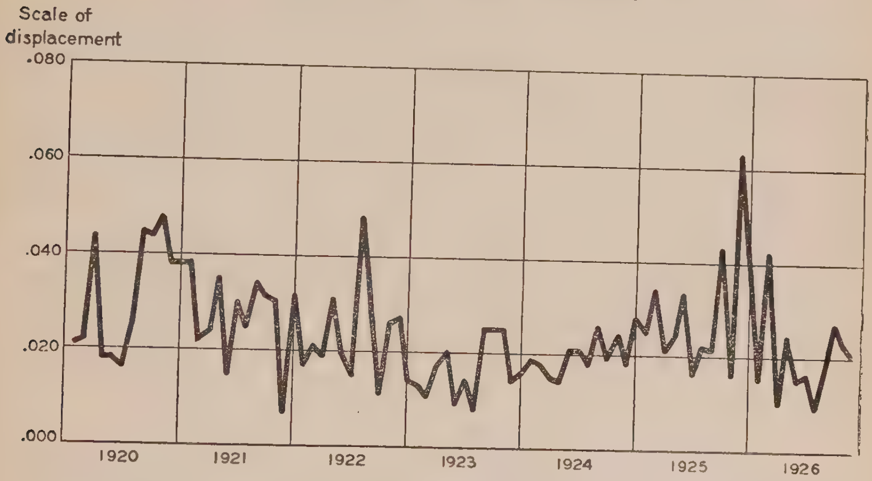
[1] See footnote, p. 271, for a list of these commodities.

FIGURE 40

Monthly Index of Price Displacement, 1920-1926.

Measures of the Degree of Shifting of Fixed Base Relatives with Reference to Preceding Month as Criterion.



Except for a markedly high value in April, 1920, registering the change in position from March to April, the values of the index of displacement were low during the first seven months of 1920. In August there was a rise, and in September a very pronounced increase. For the six month period from September, 1920 to February, 1921 the index remained very high. This was the period of drastic internal change, accompanying the general liquidation in the commodity markets. After February there came an irregular decline, a low point being reached in December, 1921. Thereafter there was a series of erratic movements, following a general downward course until August of 1923. An irregular upward movement then set in, the peak being reached in December, 1925. The index moved unevenly downward during 1926.

Spasmodic and uneven as these movements are, they tell a fairly consistent story. The disturbances which accompanied the recession of 1920 and early 1921 are clearly reflected in the movements of the index. The minor cycle which reached a peak in 1923 left slight impress upon the index, but the relatively high values which lasted from September to November of that year may probably be attributed to this factor. From 1924 to 1926 the broader movements of the index correspond roughly to the changes in the general price level, although here, as in the earlier years, the minor month-to-month changes in price relations partly conceal the underlying movements.

It was found, in studying changes in the price level and in price dispersion, that measures derived from twelve-month link relatives are free from most of the minor fluctuations which distort month-to-month measures, and that these twelve-month measures reflect clearly the broad movements in prices and in business conditions. An index of displacement measuring the shifts in relative position which have taken place over a twelve-month interval has been computed for the period 1920-1926. Price relatives for 100 commodities, on the 1913 base, have been employed. Values of the index are given in the following table, and are presented graphically in Figure 41. This index should be interpreted in connection with the corresponding measures of changes in the price level and in price dispersion which are plotted in Figure 34.

TABLE 110

Monthly Measures of Price Displacement, 1920-1926

Displacement of Fixed Base Relatives, with Reference to Twelfth Month Preceding as Criterion[1]

(Base of relatives: 1913)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Index of displacement						
Months	1920–1919	1921–1920	1922–1921	1923–1922	1924–1923	1925–1924	1926–1925
Jan.	.35	.59	.23	.22	.11	.25	.21
Feb.	.35	.58	.25	.24	.09	.22	.22
Mar.	.42	.58	.25	.27	.10	.19	.20
Apr.	.43	.58	.21	.26	.12	.17	.19
May	.44	.53	.21	.22	.12	.18	.15
June	.44	.48	.20	.20	.11	.15	.14
July	.47	.46	.23	.17	.12	.12	.12
Aug.	.47	.45	.24	.16	.15	.15	.12
Sept.	.42	.38	.22	.15	.15	.15	.14
Oct.	.51	.31	.24	.15	.15	.21	.18
Nov.	.61	.21	.22	.11	.17	.24	.14
Dec.	.58	.21	.22	.12	.20	.19	.13

---

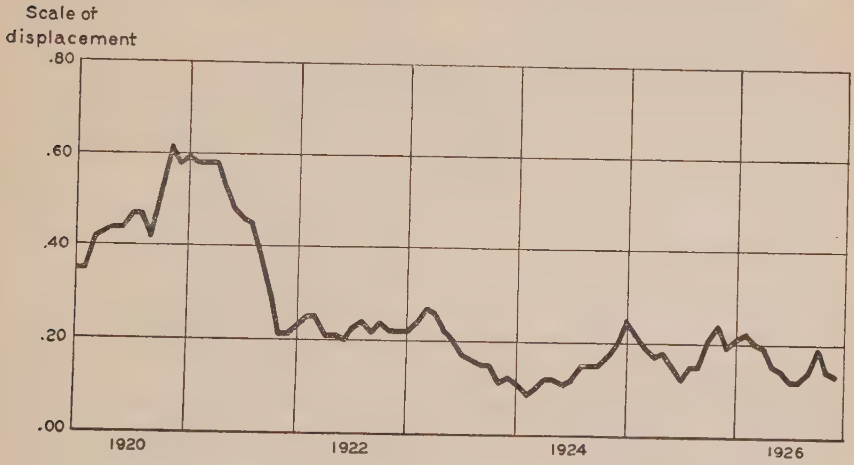
[1] The index measures the shifts in relative position between a given month of one year and the same month of the year preceding. The column headings, with the entries in column (1), indicate the months and the years to which each measure relates.

The values in the preceding table are all very much higher, it will be noted, than those in Table 109, relating to month-to-month shifts. They also exceed materially the values for corresponding years in Table 107, measuring the displacement of fixed base relatives (1913 base) from year to year. Since the relatives employed in working with monthly data are also on the 1913 base, and since the time interval is the same (12 months) for the calculations leading to the results given in Tables 107 and 110, these differences possess some significance. It appears that the shifting in position between months which are separated by a twelve-month interval is consistently greater than the shifting of annual averages for successive years. The process of averaging serves to cancel (or conceal) the effects of numerous price shifts which are revealed when monthly data are used.

FIGURE 41

MONTHLY INDEX OF PRICE DISPLACEMENT, 1920-1926.

Measures of the Degree of Shifting of Fixed Base Relatives with Reference to Twelfth Month Preceding as Criterion.



The major swings of the index of displacement over this seven year period coincide fairly closely with the movements of other indexes of price changes. The most severe disturbances, and they were very severe, judging from the average value of the index, came between November, 1920, and April, 1921. Thereafter there was a rapid and unbroken decline in the degree of displacement until November, 1921. This last date marks the end of the disturbances attendant upon the general liquidation of 1920 and 1921, in so far as they are revealed by this index. There were no appreciable changes during 1922, but a slight rise brought a minor peak in March, 1923. This was followed by a steady and considerable decline until the lowest value of the seven year period was reached in February, 1924. The degree of displacement increased month by month thereafter until January, 1925, declined until July, rose again until November, 1925, and declined somewhat irregularly throughout 1926.

In all their major swings during this period there is close agreement between the indexes of dispersion and of displacement which relate to changes over twelve-month intervals. Both indexes were relatively high prior to the break in prices in May, 1920. There was a slight decline shortly after the break started, but the continuation of the fall in prices brought sharp rises in both indexes. Thereafter abnormally high values were recorded until the end of the price decline (as recorded by the twelve-month index) in the middle of 1921. Both indexes show that the maximum disturbance in established relations came during the period of most rapid change in the price level.[1]

As a descriptive device, the index of displacement appears to be a useful supplement to measures of changes in the price level and measures of dispersion. It gives a measure of those shifts in relationship which are of such immediate concern in the ordinary processes of buying and selling. As has been indicated, it may be applied in various ways in studying price changes. The index of displacement computed from fixed base relatives, using a constant criterion, measures the degree of shifting in reference to a fixed date in the past. The same relatives may be used in measuring shifts from year to year, but the matter is complicated somewhat in this latter case by the varying degrees of dispersion of fixed base relatives at different dates. Annual data may be used in measuring the degree of displacement in reference to the immediate past, employing one- and two-year link relatives. Finally, the displacement from month to month or over a twelve-month period may be determined from monthly prices, expressed as relatives on a fixed base.

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[1] A fairly close relation between the index of dispersion based on twelve-month link relatives and the index of displacement which measures shifts, over a twelve-month interval, in the ranking of fixed base relatives is to be expected, although the methods of measurement are quite different. A considerable dispersion of twelve-month link relatives would ordinarily involve a considerable shift in the ranking of relatives for the two months concerned, when these relatives are computed upon a base some time removed.

For the same reason, some relationship is to be expected between the dispersion of annual link relatives and the displacement from one year to the next of relatives upon a fixed base.

The month-to-month measures are so greatly affected by irregular movements in the prices of individual commodities that their usefulness appears to be limited. Indexes of displacement over twelve-month intervals are free from this defect, and provide the most satisfactory measures of changes in the internal relations among commodity prices.

VI On the Characteristics of the Population of Prices

1. THE DESCRIPTION OF POPULATIONS IN TERMS OF GROUP CHARACTERISTICS: CRITERIA OF CURVE TYPE

In describing the behavior of commodity prices in combination in the preceding sections of this chapter we have dealt with two aspects of frequency distributions of price relatives, the central tendency and the dispersion, and have in addition sought to measure shifts in the relative positions of price relatives. We come now to certain other group measures, the explanation of which calls for a brief general account of methods of describing the attributes of populations.

We were concerned, in the first chapter, with the measurement of certain characteristics of individual prices. Our interest now is in the characteristics of *populations* of prices. The difference in viewpoint is a fairly obvious one, yet one which must be stressed. The entity to be described is no longer an individual but a group, and the group has attributes of an order quite different from those of individuals. Measures of group characteristics are of two classes, those which define the type of population to which the group belongs, and those which describe attributes which are unrelated to type. In the second class are two measures which have been previously dealt with, measures of central tendency and dispersion. These describe important characteristics of frequency distributions, but characteristics in respect to which populations may differ materially while still being of the same common type. Thus a group of men might differ materially from a group of women in mean height and in the degree of variation from the mean, yet the populations of which the two groups were samples might both be of the normal (i. e. Gaussian) type in respect to height.

Differences in population type possess a degree of significance not yet fully determined, but certain matters connected with this subject are of immediate interest to the student of prices. In defining such types, when the populations are represented by frequency distributions, an obvious starting point is furnished by the normal distribution. The forces which produce this type of distribution are in some degree understood, and its basic attributes have been described. But this is by no means the only form which frequency statistics take. A number of variant types have been defined, by the use of different methods. In the present study we shall make use of the methods developed by Karl Pearson, and shall employ the criteria of curve type which he designates β_1 and β_2.[1] These criteria indicate whether a given distribution is of the normal type or of some one of the chief variant types in the Pearsonian family. In defining the distribution type, the criteria yield useful information concerning the population from which the group is drawn.

These criteria furnish the units in which Figures 42, 43, 47 and 48 are scaled, and they may be most readily interpreted in connection with these charts. The values of β_1 and β_2,* in a specific case, locate a single point, and it is the position of this point which is of importance in studying the characteristics of a given population. If a distribution is of the normal type the values of the criteria β_1 and β_2 are 0 and 3, respectively. A single point on the chart, marked G (Gaussian), represents the normal type. Any deviation from these values indicates some degree of departure from the normal distribution.[2] There is, it is obvious, an infinite number of points representing non-Gaussian distributions. In the first place, therefore, the chart affords a proper perspective in viewing the relation between the normal type of distribution and other types.

If a given distribution is not symmetrical the value of β_1 will be other than zero, the sign indicating whether the skewness is positive or negative. If a given distribution is more peaked than a normal distribution with the same standard deviation the value of β_2 will be greater than 3, while if the distribution is less peaked than the normal β_2 will be less than 3. There are thus two main lines of departure from the normal type, departures in the matter of skewness and in the matter of peakedness (kurtosis). A given distribution may depart from the normal type in either of these respects, or in both.

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[1] β_1 and β_2 are derived from the second, third and fourth moments about the mean. The formulas are given above, on p. 229.

*These two criteria are positive, by construction, but in the several charts shown in this section β_1 has been given the sign of the skewness. In preparing these charts the familiar model has been modified to facilitate the following of chronological changes in the form of price distributions. A left half, which is symmetrical with the right half as designed by Pearson and Rhind, has been added. The axis representing symmetrical distributions thus stands at the center of the chart instead of at the left, as in Rhind's diagram.

[2] A departure within certain limits may, of course, be due to errors of sampling.

A more realistic impression of the significance of changes in these criteria may be gained by an inspection of the various charts in the present volume which portray frequency distributions secured in practice. Distributions of the normal type and a variety of divergent forms may be found among those pictured in Figure 21 and in the charts in Chapter IV. A general survey of these graphs will afford concrete evidence of the differences between populations in respect to those group characteristics which are our present concern.

§ Types of Frequency Distributions

The various distribution types defined by the criteria β_1 and β_2 have been classified under several heads.[1] Symmetrical distributions, represented by points on the central axis of the chart, are of three general types. These include a symmetrical, flat-topped curve ($\beta_1 = 0, \beta_2 < 3$), marked as Type II[2], a symmetrical curve more peaked than the normal ($\beta_1 = 0, \beta_2 > 3$), marked as Type VII, and the normal or Gaussian curve ($\beta_1 = 0, \beta_2 = 3$), represented by the point G on the chart. There may be, of course, an infinite number of such symmetrical distributions.

The classification of skew curves is somewhat more elaborate. The three main classes, I, IV, and VI, shade off into each other, the points and lines of transition representing distinct types. The two most important of these transition forms are those of Type III and Type V. The first of these is represented by points on the line marking the boundary between curves of Type I and Type VI. Type V is a transition form between Types VI and IV. In addition to these transition types the three important sub-divisions of Type I should be recognized. These are I_I, J_I, or J-shaped curves, and U_I or U-shaped curves. (For high values of β_1 and β_2 the field of the J-curves includes curves of Type III and VI.)

Although the area representing Types I, IV and VI covers all the space within which possible values of β_1 and β_2 will fall, Pearson's system of frequency curves may be applied only within part of this field. The limit of the area within which Pearson's curves may be fitted is marked by the line $8\beta_2 - 15\beta_1 - 36$. Areas marked IV and VI (as well as the lines for curves of Types V and VII) extend below this critical line, but distributions represented by points below this line are classed as *hetero-*

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[1] For a detailed description of these types Pearson's original memoirs should be consulted. The latest and most elaborate classification appears in "Mathematical Contributions to the Theory of Evolution. Second Supplement to a Memoir on Skew Variation," *Phil. Trans. Royal Society of London*, Vol. 216A (1915-16). This classification includes a number of transition frequency types not mentioned in the present brief discussion of these curves.

[2] Values of β_2 less than 1.8 (β_1 being zero) define a symmetrical U-shaped curve, classed as a subdivision of Type II.

typic. Heterotypic distributions cannot be described by any of Pearson's curve types, as derived by integration from his fundamental differential equation in its original form.[1] The reason for the existence of this heterotypic area is found in the high probable errors of the higher moments of frequency distributions. For distributions represented by points in the heterotypic area the eighth moment is infinitely large. (This is true, it should be noted, of the ideal distribution of which the actual distribution is assumed to be a sample. The eighth moment of the actual distribution would, of course, be finite.) The eighth moment enters into the probable error of the fourth moment and the probable error of β_2, hence an infinite eighth moment would render the probable errors of these quantities infinitely large. Thus if a sample distribution is represented by a point in the heterotypic area, we have no surety that if a second sample were taken from the same population approximately the same value of β_2 would be secured. A second sample might yield a distribution widely different in all its essential characteristics.

The characteristics of the chief curve types may be noted. Type I is a skew curve of limited range in both directions; Type VI is a skew curve of limited range in one direction and of unlimited range in the other; Type IV is a skew curve of unlimited range in both directions. Types III and V have the characteristics of Type VI in respect to skewness and range. Of the symmetrical types, the normal curve and curves of Type VII are characterized by unlimited range in both directions, while Type II is of limited range in both directions.

The different subdivisions of Type I are of interest in the present study, because a number of price distributions exemplify each of these sub-types. Curves of Type I_1 are unimodal curves of the common pattern. J-curves have no true mode, distinct from the asymptote. For such distributions the measure of skewness (which is the ratio to the standard deviation of the distance from mean to mode) loses its customary meaning, and is not comparable to measures of skewness relating to modal curves. For curves of the U-type the value corresponding to the mode is the anti-mode, and the skewness is the ratio to the standard deviation of the distance between mean and anti-mode.

Reference to Figure 42 may make this argument clearer. There have been plotted on this chart points representing a variety of distribution types.[2] This diagram will illustrate the subject at

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[1] This equation is

$$\frac{1}{y}\frac{dy}{dx} = \frac{x - a}{c_0 + c_1x + c_2x^2}$$

Pearson has suggested modifications of this basic equation from which might be derived equations appropriate to heterotypic distributions. He states that the theory of curves of this type has not been published because of his failure to find any definitely homogeneous data by which it could be effectively illustrated. (See *Phil. Trans. Royal Society of London*, Vol. 216A, p. 430.)

[2] The distributions are listed below in three main classes. In recording the criteria of curve type β_1 has been given the sign of the skewness.

(Footnote continued on next page.)

present under discussion and will serve, also, as a basis for comparison when the distributions of measures relating to commodity prices are discussed.

POPULATION TYPES

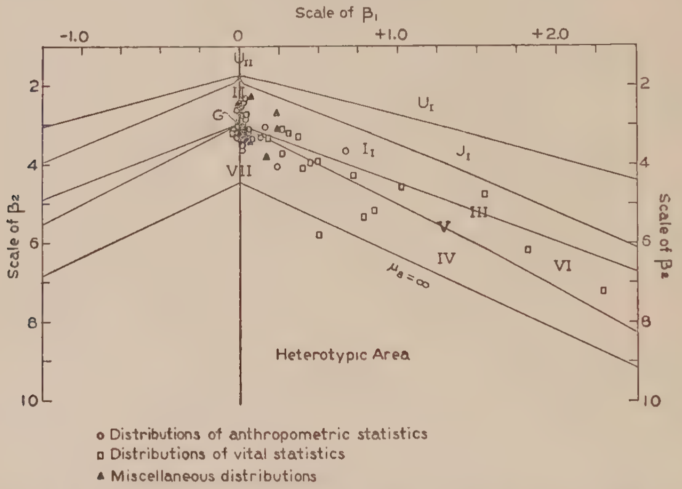
Authority	Reference	Distribution of	β_1	β_2
		Distributions of anthropometrical data		
Baxter-Pearson	*Phil. Trans. Royal Soc.*, Vol. 186-A	Heights of recruits U. S. Army	—.0058	3.0248
Davenport, C. B.	Pearson's *Tables for Statisticians and Biometricians*	Percentage of black in skin color of white and negro crosses	.6783	3.7342
Fawcett, C. D..	*Biometrika*, Vol. I	Naqada skulls		
		Length, male	—.0046	2.6560
		female	.0139	3.1054
		Breadth, male	.0824	3.3642
		female	.0002	2.5984
		Cephalic index		
		male	.0185	2.5114
		female	.0260	2.9322
MacDonell, W. R.	*Biometrika*, Vol. 1	Head breadth of criminals	—.0104	3.0326
		Height of criminals	—.0026	3.1751
Pearl, R.	*Biometrika*, Vol. IV.	Brain weights		
		Swede, male	.0287	2.7964
		female	.0508	3.1031
		Hessian, male	.1312	3.3682
		female	.0092	2.8372
		Bohemian, male	.1623	3.1396
		female	.0130	2.8671
		Bavarian, male,	.0528	3.3026
		female	.0124	3.5408
		Bavarian, young female	.2462	4.0820
Porter-Pearson	*Phil. Trans. Royal Soc.* Vol. 186-A	Heights of St. Louis school children aged 8	—.0124	3.2350
Ranke-Pearson	*Phil. Trans. Royal Soc.* Vol. 186-A	Cephalic index of Bavarian skulls	.0079	3.6496
		Distributions of vital statistics		
Elderton, W. P.	*Frequency Curves and Correlation*	2162 Females classified according to age at death	.4950	3.9961
		Marriage rates of spinsters, classified by age	1.5572	4.7813
		Endowment insurance reserves, grouped according to ages of insured	.0000	2.9210
Pearl, R.	*Medical Biometry and Statistics*	Infant mortality rates		
		Cities over		
		25,000 1915	.2723	3.1454
		1916	—.0307	3.2440
		1917	.4033	4.1274
		1918	.3168	3.2706
		Cities under		
		25,000 1915	.1804	3.4194
		1916	.2760	3.7246
		1917	1.0243	4.6218
		1918	1.8302	6.2116
		Rural counties, total		
		1915	.8579	5.1995
		1916	.3789	3.3623
		1917	.7939	5.3916
		1918	.7391	4.2810
		Rural counties, white 1917	.4937	5.8472
		1918	.4444	3.9986
		Rural counties, colored 1918	2.2973	7.2386

(Footnote concluded on next page.)

FIGURE 42

Population Types.

Diagram Showing the Location of Points Representing Various Types of Distributions.



There is a clear tendency for these points to cluster about the axis of symmetry, particularly about the point representing the

Population Types (Cont.)

Authority	Reference	Distribution of	β_1	β_2
		Miscellaneous distributions		
Fisher, R. A.	*Statistical Methods for Research Workers*	Yearly rainfall at Rothamsted	.2430	2.710
Maynard	*Biometrika*, Vol. III	Number of bands on capsules of Shirley poppies	.0196	3.308
Mills, F. C.	*Statistical Methods*	Telephone subscribers classified by calls per year	.0153	3.2007
		London-N. Y. exchange rates	.0732	2.3692
Pearl, R.	*Biometrika*, Vol. V	Length of *Chilomonas paramecium*		
		Series A	.0000	2.5657
		Series B	.0311	3.1950
		Breadth of *Chilomonas paramecium*		
		Series A	.0011	3.1332
		Series B	.1852	3.8831
Surface, Frank M.	*Biometrika*, Vol. III	Size of litters Poland China sows	.0284	3.3622
		Size of litters Duroc Jersey sows	.0167	3.3422
Venn-Pearson	*Phil. Trans. Royal Soc.* Vol. 186-A	Barometric heights	.2440	3.1739
Weldon-Pearson	*Phil. Trans. Royal Soc.* Vol. 186-A	Right antero-lateral margin of female Naples crabs	.0267	3.1128

normal distribution. Yet there are pronounced departures from this Gaussian point, departures which, in the present case, are mostly in the direction of positive skewness. The points representing anthropometric distributions are, as a group, concentrated most closely about the Gaussian point. Distributions of infant mortality rates shows the widest departures from that point.

It is to be noted that, while there is some variation between the results secured from different samples relating to a given characteristic (such as brain weights), the range of variation is small for most of the groups here represented. There is one rather conspicuous exception to this rule. The criteria of curve type vary materially for different samples of infant mortality rates. Reference to the footnote describing the distributions will show that there were marked differences between the populations from which the various infant mortality samples are drawn, a fact which undoubtedly accounts for a large part of the variation observed.

The criteria β_1 and β_2 sum up all the main characteristics of a frequency distribution, other than those defined by the measures of central tendency and dispersion. Specifically, information as to the following features of a distribution is given by these criteria:

a. The direction and degree of skewness. Any departure from symmetry is shown by a movement of the Beta point[1] away from the central axis at which the value of β_1 is zero. If the skewness is positive the point will lie to the right of the axis of symmetry, if negative, to the left of that axis, as it appears in these charts.

b. The shape of the distribution in respect to kurtosis. If the concentration at the central value is greater than would be found in a normal distribution having the same standard deviation as the distribution in question (i. e. if the distribution is more peaked than the normal) the point will lie below a horizontal line passing through the axis of symmetry at the point $\beta_2 = 3$. If the distribution is less peaked than the normal the point relating to it will lie above this line.

c. The "ideal" frequency type to which the distribution corresponds. The most important of these types have been discussed above.

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[1] The term *Beta point* has been used for convenience in referring to any point the coordinates of which are defined by values of β_1 and β_2.

There is a further type of information which these criteria may yield, though the present state of our knowledge on the subject to be discussed will hardly justify broad generalizations or unqualified conclusions. This information relates to the inherent stability of given distributions, and of the populations from which they are drawn.

Reference was made in an earlier section to the problem of price stability. External stability, or stability of the price level, was distinguished from internal stability. The latter term was used to describe stability of established relationships between individual prices and groups of prices. We are now dealing with a third (not unrelated) type of stability, the inherent stability of frequency distributions of price relatives.

What meaning can we attach to the term "stable frequency distribution"? Any frequency distribution represents the resultant of a number of separate forces. In the absence of correlation between the agencies at work, and assuming that there are so many forces in operation that no one force exerts a preponderant influence upon the data classified, something approaching stable equilibrium will be secured in the frequency distribution. In the perfect example, when positive and negative deviations are equally likely to occur, and when the distribution follows that curiously universal pattern first traced by Laplace and Gauss, a condition of true stability has been attained. The forces tending to produce values above the mean are precisely balanced by forces pulling in the other direction. So fine is the balancing of diverse forces that, knowing the normal law of error to be in operation, it is possible to foretell, within limits capable of precise evalution, the exact proportion of observations which will depart by given amounts from the mean value. Under these conditions, says Pearson, " . . there is production and destruction impartially around the mean."

A stable frequency distribution may be thought of, then, as one which embodies the balanced condition reflected in most perfect form in the normal curve. There is variation, but the forces of disruption are held in check by cohesive agencies. The population from which the distribution in question is drawn is not subject to "sport" types departing from the norm by amounts which are excessive, in terms of the standard deviation of that population. Sporadic variation plays, in perfect balance, within assignable limits. *Stability of type* is generated by the balance of forces responsible for individual variation. In this sense, then, stability is a group characteristic. Frequency distributions constructed from measurements of those biological characteristics which are most stable (e. g., stature, skull dimensions, brain weight) are of this normal type, or approximate it closely. Unstable organisms may be expected to yield distributions departing materially from the normal type, these departures representing break-downs, "sports," and erratic individual variations.

If a distribution of the normal type represents a condition of stable equilibrium, it may be assumed that departures from that type indicate the presence of some unstable element or elements. Yet all departures are not of equal significance. The Gaussian distribution is secured, Pearson has pointed out, when each contributory cause group is independent and when (if the number of groups be not very large) each cause group is of equal valency and contributes with equal frequency results in excess and defect of its mean contribution. The conditions which yield a Type III distribution are closest to those which give rise to the Gaussian type. The contributory cause groups are of equal valency and are independent, as for the Gaussian type, but Type III differs from the Gaussian in that each cause group does not necessarily contribute with equal frequency results in excess and defect of its mean contribution. Type III corresponds to the skew binomial.[1] In employing the fundamental differential equation used in deriving the other curve types in Pearson's system it is not necessary to assume the independence or equal valency of the cause groups, nor the equality of contributions above and below the mean.

In studying the characteristics of frequency distributions of price relatives it will be of interest to observe the degree of departure of given distributions from the normal type and from Type III, considering these to be representative of more stable populations than the other frequency types in the Pearsonian system.[2]

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[1] See Pearson, *Tables for Statisticians and Biometricians*, p. lxi, and Pearson, "Skew Variation in Homogeneous Material," *Phil. Trans. of the Royal Society*, Vol. 186 A, pp. 356-360,381. See also, Kelley, Truman L., *Statistical Method*, p. 148, for a comment on the point in question.

[2] This subject of the relation between curve type and stability of populations has been discussed in a very illuminating fashion by Truman L. Kelley (*Statistical Method*, pp. 138-150). In the course of this discussion Kelley emphasizes certain distinctive characteristics of the distribution types which have been mentioned above as being most stable. Type III distributions, he shows, are the only ones which do not possess certain infinite positive moments (i. e. moments which become infinite for a fitted curve). Just as these Type III distributions are unique, in that all their positive moments are finite, so distributions of Type V are unique, in possessing finite negative moments. The lines representing Type III and Type V distributions meet, it may be observed, at the Gaussian point (see Figure 42). From which facts Kelley draws the conclusion:

Statements in the preceding paragraphs suggest some of the causes of instability of type, as that phrase is used in the present discussion. Unstable elements may be present when essentially homogeneous data are subject to the interaction of factors too limited in number or of such marked inequality that certain forces exert a preponderant influence. Again, correlation between the factors affecting the quantities measured tends to destroy the balance characteristic of stability. Probably the most important of the conditions which give rise to departures from Type III, as well as from the normal type, is this factor of dependence of the contributory causes or, in Kelley's phrase, of "uncompensated correlation between cause groups."

In addition to that type of instability which is evidenced by "skew variation in homogeneous material" we may have the instability which is found when the data classified consist of a mixture of heterogeneous materials. In this case the groups which are mixed may be subject, in their variation, to essentially different forces, a fact which would ordinarily give rise to distribution types departing materially from the normal.[1] In the study and comparison of price groups at a later point in the present investigation (to be discussed in a later volume) we shall return to the subject of heterogeneity of populations, and shall discuss methods of testing for heterogeneity.

As distributions depart from the normal type there is always some loss in both the significance and the reliability of the statistical measures descriptive of the populations represented. They lose in significance because there is not the clear central tendency and the uniform deviation from the central tendency which may be most accurately described. They lose in reliability because of an increase in the sampling errors to which all statistical measures are subject. As the degree of departure from the stable Gaussian type and Type III increases, the tendency toward a breakdown of the distribution type increases. The statistical evidence of this tendency

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"If......finite positive moments are of most importance III is the most stable of all the types; however, should finite negative moments be of greater importance than positive, Type V would be the most stable; and if the possession of both finite positive and negative moments is material then the normal distribution is the most stable curve within all the types." (p. 143).

[1] This is not necessarily true, for a heterogeneous distribution might take the Gaussian form. In an early article in *Biometrika* ("Das Fehlergesetz und seine Verallgemeinerungen durch Fechner und Pearson," A Rejoinder. *Biometrika*, Vol. IV) Pearson effectively demonstrated that correspondence of a distribution to the Gaussian type is not necessarily evidence of homogeneity, and that departure from the normal type is not evidence of heterogeneity.

is found in the magnitude of the sampling errors, which may become so large that there can be no confidence that a second sample from a given population will yield a distribution of the same type as the first sample.

§Criteria of Instability

Somewhat more specific information concerning instability of type is afforded by two of the criteria Pearson has employed in defining his basic frequency types. These are the measures represented by the symbols κ_1 and r. The criterion κ_1 is derived from the following relationship:[1]

$$\kappa_1 = 2\beta_2 - 3\beta_1 - 6$$

The type of information given by κ_1 may be made clear by reference to Figure 42. On this chart a line appears, representing the locus of the points for which $\kappa_1 = 0$. This is identical with the line representing Type III distributions. If κ_1 is positive, in a given case, the Beta point falls below this line, in the regions of Type IV, V and VI. If κ_1 is negative the Beta point falls above this line, in the Type I area. The value of κ_1 indicates the degree of departure of the given point from the line and, correspondingly, the degree of departure of the given distribution from Type III.

Some of the characteristics of Type III distributions have been noted above, with particular reference to the problem of stability of type. On the assumption that finite positive moments are of greatest importance in the material with which we are at present dealing, the criterion κ_1 may serve as a measure of stability. A value of zero means perfect stability, in that all positive moments are finite. As the value of κ_1 departs from zero the moments, beginning with the highest, become infinite. The greater the value of κ_1, on this assumption, the less stable is the distribution.

In deriving the other criterion which concerns us here we set

$$r = \frac{6\,(\beta_2 - \beta_1 - 1)}{2\,\beta_2 - 3\beta_1 - 6}$$

Since the denominator of the right hand member of this equation is equal to κ_1 it is clear that r and κ_1 are related. When κ_1 is equal to zero, as it is for the normal curve and for distributions of Type III, r will be equal to infinity. It descends from infinity, with positive values, below the Type III line, and descends, with negative values, above that line. The numerator of the above fraction is necessarily positive, hence r will agree in sign with κ_1. But r yields certain additional information which κ_1 does not. On a preceding page reference has been made to the high probable errors of the higher moments of frequency distributions. It has been pointed out that for distributions represented by points in the heterotypic area the eighth and all higher moments (of the ideal distributions represented by the sample) are infinitely large. The criterion r indicates the order of the moments which, in a given case, would be infinite. If r is equal to any value, m, then the moment of the order $m + 1$ would be infinite. Thus if r is equal to 7, the eighth and all higher moments are infinitely large for the ideal distribution of which the actual distribution is a sample. Under the conditions last named the value of β_2 as determined from the sample has an infinite probable error. We may, therefore, determine from the value of r in a given case whether a distribution is heterotypic. This will be true when r, being positive, is equal to or less than 7. If r is equal to 3, the fourth and all higher moments are infinitely large and the value of β_2 for the ideal curve becomes infinite. If r has a value between 0 and 1 the second moment and the standard deviation become infinite.

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[1] In this and similar equations which follow β_1 is taken as positive. This measure is positive by construction, but in preparing the graphs β_1 has been arbitrarily given the sign of the skewness.

Since r indicates the order of the moments which break down for specific distributions (i. e. become infinite for the corresponding ideal distributions) it may appropriately be employed as a measure of stability of type, as that term is here used. The greater the value of r the higher is the order of the moments which become infinite and the more stable are the distributions represented. As r approaches infinity the corresponding distributions approach the normal type, or Type III. These two types appear, as has been pointed out, when the causal factors are independent and when the cause groups are of equal valency. The lower the absolute value of r, whether the sign be positive or negative, the less stable is the distribution.[1]

One of the most important aspects of this problem of instability of distributions relates to the heterotypic area which is shown in Figure 42, and to which reference has been made above. No precise meaning has been given to the term *heterotypic*. It is clear that if a distribution falls in this area the probable errors of the criteria of curve type are so great that there can be no confidence that other samples from the same population would yield results within reasonable limits of those secured from the first sample. But of what sort of distribution is this true? It has been suggested that a tendency toward bi-modality may account for the location of a distribution in this area, but the results of the present study support Truman Kelley's assertion that this is not necessarily true. It is Kelley's contention that the location of a distribution in the heterotypic area indicates the presence of essentially unstable elements, elements conducing to a breakdown of type. The high probable errors of the moments indicate not only the unreliability of sampling, but a tendency toward erratic and disruptive movements on the part of individual members of the population. With reference to animal organisms, we might say that it indicates the possibility of thoroughly abnormal "sports" which would break completely away from the prevailing type. It suggests that the pull toward the center of gravity of the distribution may be so relaxed that individual members of the population might break loose, as planets might escape from a parent sun. This is, however, a field in which the present state of our knowledge does not justify any final conclusions. It is certain that for distributions which fall in this region the ordinary measures used in describing frequency distributions and in generalizing from them lose materially in reliability and utility. And there are some reasons for thinking that this failure of the orthodox type is due to elements of instability in the populations from which given samples are drawn.[1]

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[1] The uses of r are discussed in the various references to Pearson which have been given above. Extensive use of this criterion has been made by R. A. Fisher in his memoir "On the Mathematical Foundations of Theoretical Statistics" (*Phil. Trans. of the Royal Society*, Vol. 222-A, 1921-22, pp.309-368). In defining the frequency types of the Pearsonian system Fisher employes a diagramatic method which is based primarily upon r, and which differs materially from the method represented by Figure 42.

2. CHARACTERISTICS OF FREQUENCY DISTRIBUTIONS OF PRICE RELATIVES

With the above considerations before us we may proceed to a discussion of the attributes of the population of prices. For the present we are concerned with just one characteristic of commodity prices—degree of change between specific dates, as measured by link and fixed base relatives—and conclusions concerning the population of prices are to be interpreted with this in mind.

In Tables XIX to XXVII, in the Appendix, are given the criteria of curve type and related measures descriptive of various distributions of price relatives for the years from 1891 to 1926. In order that chronological changes in the character of certain of these distributions may be followed, the criteria β_1 and β_2 for two sets of distributions (unweighted fixed base relatives in natural form and weighted logarithms of link relatives) have been plotted in Figures 43 and 48.

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[1] R. A. Fisher has explained the failure of the orthodox types within the heterotypic area as due to the inadequacy of the method of moments in estimating the parameters of populations from samples which are heterotypic (see Fisher, "On the Mathematical Foundations of Theoretical Statistics," p. 346). Pearson's system rests upon the method of moments. Moreover, Fisher contends, the inadequacy of the method of moments is not confined to dealing with heterotypic distributions; this method falls far short of a perfect standard of efficiency in estimating the form of distributions of other types, notably J-shaped distributions. The efficiency of the method of moments is high, says Fisher, only in the neighborhood of the Gaussian point.

It is probably not necessary to set in opposition these two explanations of the failure of the Pearsonian frequency types as means of estimating the form of ideal curves corresponding to certain distributions. It may be granted that the method of moments loses in efficiency as it is applied to distributions departing materially from the normal type. Yet the departure of a given distribution from that type may still be taken to mean that the population from which this sample was drawn is subject to the play of unbalanced forces and contains unstable elements.

The first point to be noted in an examination of these diagrams is the fact of extreme year-to-year changes in distribution type. The population with which we are dealing is one which changes its fundamental characteristics from year to year. No such extreme differences are to be found between the results secured from different samples of brain weights, infant mortality rates, or skull dimensions, measures for which were presented above. It may be, however, that we are not justified in thinking of these results for different years as samples from a single population. Link relatives measuring the changes in individual commodity prices between 1915 and 1916 reflect the play of a set of forces quite different from those which influenced the link relatives for 1921, on the 1920 base. If we are to think of price relatives as constituting a population, we should perhaps view the relatives for each year as a population by themselves. Whether the specific changes from one year to the next possess economic significance is discussed below.

The descriptive measures given in the Appendix tables permit detailed study of the populations secured by combining price relatives in different forms. Various distributions may be compared in regard to stability of type, degree of skewness and dispersion, closeness of correspondence to the normal or any other ideal frequency type, and in other respects. In such a study a three-fold comparison is possible.

Distributions of the logarithms of price relatives may be compared with distributions of price relatives in natural form.

Distributions of weighted price relatives may be compared with distributions of unweighted relatives.

Distributions of fixed base relatives may be compared with distributions of link relatives.

In each case, of course, the comparison involves distributions differing in one characteristic only. Thus in comparing logarithmic and natural distributions the measures relating to unweighted logarithms of link relatives for 1920 would be compared with similar measures relating to unweighted link relatives in natural form for 1920. Measures of dispersion, and all other measures, were put on comparable bases before the comparison was made.[1]

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[1] In the case of measures of dispersion this was done by expressing $.6745\sigma$, in natural numbers, as a percentage of the mean. This value was compared with the index of dispersion derived from logarithms. (The derivation of this index is explained on p. 257.)

§Comparisons of Distributions of Price Relatives
Arithmetic and Logarithmic Distributions

The first of these comparisons is permitted by the figures in the table below.

TABLE 111

COMPARISON OF DISTRIBUTIONS OF LOGARITHMS OF PRICE RELATIVES AND DISTRIBUTIONS OF PRICE RELATIVES IN NATURAL FORM
(Based upon prices during the period 1913-1926)

Characteristic	No. of pairs of distributions compared	Result
1. Mean value		Logarithmic (geometric) mean necessarily smaller in all cases.
2. Dispersion	136	Log dispersion smaller 70 times.
3. Skewness	50	Log skewness smaller 37 times.
4. Sign of skewness	50	Log skewness negative 26 times. Natural skewness negative 6 times.
5. Kurtosis	50	Log closer to normal 36 times.
6. Location in respect to heterotypic division	50	Number of log distributions heterotypic: 30 Number of natural distributions heterotypic: 21
7. Stability (measured by κ_1)	50	Log more stable 34 times.
8. Curve type[1]	50	Logarithmic distributions: Type I 3 Type IV 43 Type VI 4 Natural distributions: Type I 8 Type IV 28 Type VI 14

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[1] A number of the distributions classified in this table might have been placed among the transition types, if account were taken of the sampling errors to which the criteria β_1 and β_2 are subject. In view of the magnitude of these sampling errors for points near the heterotypic limit and within the heterotypic area, it has been considered more significant to group the distributions into the three main classes, and their sub-classes, which are defined by areas, not by points or lines.

Of the 8 natural distributions of Type I, 5 were of the sub-type I_J; of the 14 of Type VI, 8 were of the sub-type VI_J.

Of the 3 logarithmic distributions of Type I, 1 was of the sub-type I_J; of the 4 of Type VI, 1 was of the sub-type VI_J.

(See p. 314 for a brief description of these curve types.)

Only 50 pairs of distributions are directly comparable in the matter of curve type. We have data, however, relating to 96 logarithmic distributions (of which approximately two-thirds were based upon link relatives) and 94 distributions of relatives in natural form (of which approximately two-thirds were constructed from fixed base relatives). The comparison is not as trustworthy as that given in the table, but it possesses significance, since no essential difference was found between fixed base and link relatives in this regard. The classifications follow:

Curve type	Number of logarithmic distributions of given type	Number of natural distributions of given type
I	8	11
IV	85	62
VI	3	21
	96	94

One of the logarithmic distributions of Type I and one of the logarithmic distributions of Type VI belonged to sub-groups of the I_J and VI_J types, respectively.

Five of the natural distributions of Type I were of sub-type I_J, and 11 of the natural distributionsof Type VI were of sub-type VI_J.

The logarithmic and arithmetic measures of dispersion were commented upon in an earlier section. It was there pointed out that there is no evidence of a consistent tendency for one to exceed or fall below the other. When prices are seriously disturbed, however, as they were during the war and immediate post-war years, the arithmetic standard deviation is subject to extreme fluctuations. During the years 1915 to 1918 this was particularly true of unweighted distributions of price relatives on a fixed base. Though the logarithmic measures of dispersion were in many cases greater than the corresponding natural measures, they never exceeded the arithmetic measures by any considerable margin. During years when price disturbances are less extreme there appears no tendency for the logarithmic dispersion index to exceed or fall below the corresponding arithmetic measure.

The logarithmic distributions tend, on the whole, to be more symmetrical than the arithmetic. Out of the 50 comparisons which were possible, the measures of skewness of the logarithmic distributions were smaller in 37 cases than the measures relating to corresponding arithmetic distributions. This is due, of course, to the fact that the range of positive deviations is much less in the logarithmic than in the natural distributions. Price relatives in natural form are subject to extreme positive deviations, since the upper limit of such a relative is infinity, while the lower limit is zero. For the same reason we find that the logarithmic distributions were negatively skewed 26 times out of 50 cases, while natural distributions were negatively skewed in only 6 out of 50 cases.

The logarithmic distributions tend, also, to be less peaked than the arithmetic. The general tendency of all distributions of price relatives is to be more peaked than the normal, but this tendency is more pronounced in the arithmetic type.

On *a priori* grounds (reasoning from the known characteristics of price relatives in logarithmic and natural form in the matter of range) one might expect Type IV, the skew, peaked curve with theoretically unlimited range in both directions, to predominate among logarithmic distributions, and Type VI, which is skewed and peaked and which has a theoretically unlimited range in only one direction, to predominate among arithmetic distributions. In fact, both logarithmic and arithmetic distributions are preponderantly of Type IV, but the proportion of distributions of this type is much greater among the logarithmic than among the arithmetic distributions. Among the arithmetic distributions Type VI ranks next in importance to Type IV. Type I has 3 representatives among the logarithmic distributions and 8 among the natural. (The count is based upon the distributions for the years 1914-1926.)

Several measures which serve as indexes of the inherent stability of distribution types have been discussed above. Judged with reference to distance from the Type III line, which represents, presumably, the most stable skew type, logarithmic distributions of price relatives appear to be more stable than natural distributions. In 34 out of 50 cases distributions based on logarithms deviate from this type by smaller amounts than the corresponding natural distributions. (The criterion here employed is κ_1.)

Another comparison may be made, employing the criterion r, which indicates the "break-down" point of different distributions. That is, it indicates the order of moments which become infinite. The results of the comparison, which is restricted to positive values of r, are summarized in the following table. The distributions here compared relate to the period 1914-1926.

Range of positive values of r	Number of distributions for which the values of r fall within the stated limits[1]	
	Logarithmic	Natural
7.00, or below	30 out of 50 cases	21 out of 50 cases
6.00, or below	17 out of 50 cases	15 out of 50 cases
5.00, or below	13 out of 50 cases	10 out of 50 cases
4.00, or below	1 out of 50 cases	4 out of 50 cases

[1] The various sub-totals in this table are cumulative, hence the sum of the items in each column is not necessarily equal to the total number of distributions (50) studied in each case. Thus, for example, the 17 logarithmic distributions for which the value of r was 6, or below, are included in the 30 distributions for which the value of r was 7, or below. The 20 logarithmic distributions and the 29 natural distributions for which the value of r exceeded 7 are not, of course, listed in the above table.

If r has a value of 7 or less, it will be recalled, the eighth moment of the ideal distribution corresponding to the sample is infinite, and the probable error of β_2 is infinite. This marks the limit of the heterotypic area. If r has a value of 6, or less, even greater instability is indicated, for this means that the seventh and all higher moments are infinite.

Judging from all the entries but the last in the above table, logarithmic distributions appear to be less stable than natural distributions. Thirty of the 50 logarithmic distributions are heterotypic, while only 21 of the corresponding 50 natural distributions fall in this region. The last entry in the table shows that 4 of the natural distributions and 1 logarithmic distribution are characterized by infinite fifth moments.

The better showing of the natural distributions in this comparison is not due to any tendency on their part to cluster about the normal point, or about the stable Type III line, as was indicated by the values of κ_1. During times of extreme price disturbance natural distributions, particularly unweighted distributions, tend to deviate above the Type III line, into the area of J-curves of Type I. This is the type of distribution followed by unweighted fixed base relatives in natural form in 1915, 1916, 1917 and 1918, by unweighted link relatives in natural form in 1915, and by weighted link relatives in natural form in 1923. Judging solely on the evidence of positive moments these are stable distributions, and the measures describing them are valid. R. A. Fisher has shown, however, that the efficiency of the method of moments in locating and scaling such J-curves is very low. All J-curves fall beyond what Fisher calls the "region of validity" of the first moment. The upper boundary of the region of validity of the second moment is set by the line $r = -4$, a line beyond which 5 of the distributions of price relatives in natural form fall. The means and standard deviations relating to these distributions are not characterized by the infinite probable errors which are found when positive moments of a low order are infinite, but are equally unacceptable because of their inadequacy as measures descriptive of the population of prices.[1] Because of the existence of this upper boundary to the efficiency of the statistics descriptive of the natural distributions, it does not seem justifiable to conclude that the natural distributions are preferable to the logarithmic because a smaller proportion of the natural distributions fall in the heterotypic area. In fact, were one to base a choice between the two upon the basis of the efficiency of the first and second moments (i. e. of means and standard deviations) the logarithmic distributions would be selected. For the proportion of logarithmic distributions falling within the region of validity of the first and second moments is slightly greater than the proportion of natural distributions.

In a final comparison we may determine the number of logarithmic and natural distributions which correspond in type to the normal curve of error, noting at the same time the character of the deviation from the normal type. The results appear in the following table. In preparing this table the actual measures of skewness and kurtosis have been compared with the standard errors of these measures for samples from normal distributions. If a given measure of skewness or kurtosis differed from the Gaussian value of 0 by less than 2.576 times its standard error, the deviation was not considered significant. A greater deviation was taken to mark a significant departure from the normal type.[2] The distributions here classified relate to the period 1914-1926.

Form of price relatives	Number of distributions deviating from normal type in respect to			Number of distributions conforming to normal type in respect to skewness and kurtosis (within sampling limits indicated in the text)	Total
	skewness alone	kurtosis alone	skewness and kurtosis		
Natural	2	2	44	2	50
Logarithmic	1	8	38	3	50
Total	3	10	82	5	100

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[1] This upper boundary, says Fisher, is set not because the probable errors of the moments become infinite, but because "the ratio of the probable errors of the moments to the probable error of the corresponding optimum statistics is great and tends to infinity as the size of the sample is increased." ("On the Mathematical Foundations of Theoretical Statistics," p. 347.) The optimum statistics are those of which the likelihood is greatest. The concept of maximum likelihood is developed by Fisher in the article named, and is exemplified in Fisher's *Statistical Methods for Research Workers*, (Edinburgh, 1925).

[2] The standard error multiplied by 2.576 marks the limit beyond which a deviation would fall as the result of chance less than 1 time out of 100.

Most of the distributions in both groups differ from the normal type in respect to both skewness and kurtosis. The tendency toward greater symmetry in the case of logarithmic distributions accounts for the larger number in this group which deviate from the normal type in respect to kurtosis alone. Only five of the total group of 100 distributions could be considered normal, even within the generous sampling limits upon which this classification rests.

Weighted and Unweighted Distributions

The effect of weighting upon the form of frequency distributions of price relatives is revealed by the entries in the following table.

TABLE 112

COMPARISON OF WEIGHTED AND UNWEIGHTED DISTRIBUTIONS OF PRICE RELATIVES

(Based upon prices during the period 1890-1926.)

Characteristic	No. of pairs of distributions compared	Result
1. Mean value	136	Wtd. smaller 57 times
2. Dispersion	136	Wtd. smaller 74 times
3. Skewness	95	Wtd. smaller 57 times
4. Sign of skewness	95	Wtd skewness negative 35 times Unwtd. skewness negative 33 times
5. Kurtosis	95	Wtd. closer to normal 68 times
6. Location in respect to heterotypic division	95	No. of wtd. distributions heterotypic: 41 No. of unwtd. distributions heterotypic: 49
7. Stability (measured by κ_1)	95	Wtd. more stable 61 times
8. Curve type[1]	95	Wtd. distributions Type I 10 Type IV 71 Type VI 14 Unwtd. distributions Type I 9 Type IV 76 Type VI 10

[1] Six of the 14 weighted distributions classed in Type VI were of the sub-type VIJ. Six of the 9 unweighted distributions in Type I were of the sub-type IJ, and 6 of the 10 of Type VI belonged in the subgroup VIJ.

Weighted and unweighted distributions of price relatives have been compared in respect to mean value and dispersion in earlier sections. It may be noted here that the effect of the introduction of weights based upon values marketed in the period 1919-1923 was to increase the mean value during the period 1891-1913, and to decrease the mean value during the years 1914-1926. There seems to have been no consistent difference between weighted and unweighted measures in the matter of dispersion prior to 1914. During the years of violent price change since 1914 the dispersion of weighted distributions has been smaller in about three-quarters of the cases compared.

The departures from symmetry were somewhat less pronounced for weighted than for unweighted distributions, but this result is due entirely to the situation since 1914. The weighted skewness was less in 34 out of 50 cases in this period. During the less disturbed period preceding, the skewness of the weighted distributions was less in 23 out of 45 cases. The skewness was negative in almost precisely the same proportion of unweighted and weighted distributions.

The use of weights serves substantially to decrease the peakedness of price distributions. The weighted distributions were closer to normal in this respect during both the earlier and later years of the period covered, the advantage being in favor of the weighted distributions in 68 out of 95 cases.

There is no material difference in the type of ideal distributions to which the members of the two groups belong. In both cases over 70 per cent of the distributions are of Type IV, with Type VI and Type I standing next in order of importance.

The available evidence indicates that combinations of weighted price relatives yield more stable distributions than do combinations of unweighted relatives. Weighted distributions are more stable in 61 cases out of 95, as judged by κ_1 (which measures the distance from the Type III line). When the criterion r is employed in the comparison, the following results are secured.

Range of positive values of r	Number of distributions for which the values of r fall within the stated limits	
	Unweighted	Weighted
7.00, or below	49 out of 95 cases	41 out of 95 cases
6.00, or below	40 out of 95 cases	30 out of 95 cases
5.00, or below	19 out of 95 cases	17 out of 95 cases
4.00, or below	1 out of 95 cases	8 out of 95 cases

The proportion of unweighted distributions which are heterotypic (i. e. for which r is positive and equal to 7 or less) is greater than the corresponding proportion of weighted distributions. On the other hand, a larger number of weighted distributions fall in the last group in the table, in which are tabulated the distributions for which the fifth and all higher moments are infinite.

In the following table unweighted and weighted distributions are compared in the matter of correspondence to the normal curve of error. The distributions here classified relate to the period 1891-1926.

Form of price relatives	Number of distributions deviating from normal type in respect to			Number of distributions conforming to normal type in respect to skewness and kurtosis (within the sampling limits indicated in the text)	Total
	skewness alone	kurtosis alone	skewness and kurtosis		
Unweighted	2	17	72	4	95
Weighted	4	13	64	14	95
Total	6	30	136	18	190

The most pronounced difference between the two sets of figures presented is found in the column showing the number of distributions conforming to the normal type. Fourteen weighted and only four unweighted distributions are in this group. The proportion of the total number of distributions which may be considered normal (within the sampling limits defined above) is small in both cases, but it is relatively much greater for the weighted measures.

Distributions of Fixed Base and Link Relatives

The final comparison involves distributions constructed from fixed base and link relatives. The basic data appear in the following table.

TABLE 113

Comparison of Distributions Constructed from Fixed Base and Link Relatives of Commodity Prices, for the Period 1914-1926

Characteristic	No. of pairs of distributions compared	Result
1. Mean value		(Comparison not significant)
2. Dispersion	128	Link smaller 128 times
3. Skewness	48	Link smaller 26 times
4. Sign of skewness	52	Link skewness negative 18 times Fixed base skewness negative 17 times
5. Kurtosis	48	Link closer to normal 31 times
6. Location in respect to heterotypic division	52	Number of link distributions heterotypic: 27 Number of fixed base distributions heterotypic: 27
7. Stability (measured by κ_1)	48	Link more stable 28 times
8. Curve type[1]	52	Link / Fixed base Type I: 6 / 5 Type IV: 35 / 40 Type VI: 11 / 7

[1] One of the 6 link distributions classified as of Type I was of sub-type I_J; 4 of the 11 classed as of Type VI belonged to sub-group VI_J.

The 5 fixed base distributions of Type I all were of sub-type I_J; 5 of the 7 classed as of Type VI belonged to sub-group VI_J.

It is to be expected, of course, that the dispersion of link relatives should be smaller than that of fixed base relatives. There is no material difference in the matter of skewness. It is apparent that the greater dispersion of fixed base relatives, as the base becomes further removed, does not result in any appreciable change in the degree of skewness. Nor is there an appreciable difference between the two types of distributions in respect to the direction of skewness.

The link distributions are distinctly less peaked than the fixed base distributions for the period from 1914 to 1926. In 32 out of 48 cases the link distributions are more flat-topped than the others, and in 31 of these 32 cases the link distributions are closer to the normal curve in this respect. In interpreting these results it must be remembered that the measure of peakedness refers always to a normal distribution having the same standard deviation as the distribution in question. Since the dispersion of the link distributions is less, in all cases, these distributions look more peaked when presented in graphic form. They are not so, however, when the criterion of peakedness is a normal curve with the same degree of dispersion. It is possible that a somewhat different proportion would prevail if comparison of a number of pre-war distributions were possible. The abnormally wide dispersion of fixed base relatives between 1915 and 1918 is reflected in high values of the measure of kurtosis.

In the matter of curve type there is no material difference between link and fixed base distributions. In both cases Type IV predominates.

The criterion κ_1 shows that the distributions composed of link relatives are closer to Type III in 28 out of 48 cases. If we use the values of r in testing stability, we secure the following results, based upon prices during the period 1913-1926 (distributions for the years 1914-1926).

Range of positive values of r	Number of distributions for which the values of r fall within the stated limits	
	Link	Fixed base
7.00, or below	27 out of 52 cases	27 out of 52 cases
6.00, or below	22 out of 52 cases	23 out of 52 cases
5.00, or below	13 out of 52 cases	12 out of 52 cases
4.00, or below	1 out of 52 cases	4 out of 52 cases

The number of link relative distributions falling in the heterotypic area (i. e. having values of r equal to or less than 7.00) is precisely equal to the number of distributions of fixed base relatives in this class. In certain other respects, however, the fixed base relatives are less adequately described by the usual statistical measures (i. e. more fixed base than link distributions fall beyond the boundary marking the upper limit of the validity of the first and second moments). There is, however, slight basis for a choice between them on the basis of this evidence.

Finally, comparing these distributions in respect to conformity to the normal type, we have the following figures. These relate to distributions for the years 1914-1926.

Form of price relatives	Number of distributions deviating from normal type in respect to			Number of distributions conforming to normal type in respect to skewness and kurtosis (within sampling limits indicated in the text)	Total
	skewness alone	kurtosis alone	skewness and kurtosis		
Link	2	7	39	4	52
Fixed base	1	4	46	1	52
Total (including duplicates)	3	11	85	5	104

Four of the five distributions which approximate the normal type are composed of link relatives. The other figures confirm this evidence in indicating a slightly less pronounced departure from the normal type in the case of link relatives than is found for fixed base relatives. But the deviation from the normal law is great for both groups of distributions.

Certain of the results of these comparisons may be summarized.

a. Arithmetic and logarithmic distributions
  1. In respect to dispersion logarithmic distributions are not subject to the extreme fluctuations characteristic of natural distributions during periods of price disturbance.
  2. Logarithmic distributions are more symmetrical than natural distributions.
  3. The tendency toward peakedness is more pronounced among arithmetic than among logarithmic distributions.
  4. Taking all the evidence into account, the logarithmic distributions appear to conform to the stable frequency types (the Gaussian and Type III) somewhat more closely than do the natural distributions. They appear, also, to be capable of somewhat more efficient location and description by the methods commonly employed than are the distributions of price relatives in natural form. The departures from the stable types are, however, very pronounced for both types of distributions.

b. Unweighted and weighted distributions
  1. The dispersion of weighted distributions was generally

smaller during the extreme price disturbance of the war and post-war years. During other periods no consistent difference has been noted.

2. Weighted distributions appear to be more symmetrical than unweighted during periods of price disturbance. At other times no difference is apparent.
3. The use of weights decreases the abnormal peakedness characteristic of distributions of price relatives.
4. Weighted price relatives, in combination, yield more stable distributions than do unweighted relatives. Part of the evidence on this point consists of the fact that 14 out of 95 weighted distributions conformed to the normal type (within sampling limits), while only 4 of 95 unweighted distributions were of the Gaussian type.

c. Distributions of fixed base and link relatives
   1. There is no significant difference between distributions of fixed base and link relatives in respect to symmetry.
   2. Link distributions, for the period 1914 to 1926, are less peaked than are fixed base distributions (the standard of comparison being, in each case, a normal distribution having the same standard deviation as the distribution in question).
   3. There is little difference between link and fixed base distributions in respect to stability of type. The departure from the normal type appears to be slightly less pronounced for link relatives than for fixed base relatives.

In concluding this section the general characteristics of frequency distributions of price relatives may be noted. Classifying these distributions by type, we have:

Type I	19
Type IV	147
Type VI	24

(Of the 19 distributions of Type I, 6 belonged to sub-group I_J, and 12 of the 24 distributions of Type VI belonged to the sub-class VI_J).

One conclusion stands out clearly from a survey of these results. Price relatives are not, in general, distributed in accordance with the normal law of error. This conclusion holds whether we deal with link or fixed base relatives, and whether these relatives be combined in natural or in logarithmic form. Of the entire 190 distributions which have been analyzed, all but 18 differ from the normal type in respect to skewness, or kurtosis, or both, by amounts which are not consistent with the hypothesis that the populations sampled are distributed according to the normal law of error. (See table on p. 331). The sampling errors for which allowance was made in arriving at this figure were large, so that 18 must be looked upon as a generous estimate of the number of distributions which might be described by the normal curve.[1] The great majority of the distributions (136 out or 190) depart from the normal type in respect to both skewness and kurtosis. Of the 36 cases in which one factor alone is significantly non-Gaussian, 30 involve the factor of kurtosis, and only 6 that of skewness. It would appear that the excessive concentration of cases near the modal value is somewhat more important than the factor of skewness in causing distributions of price relatives to depart from the normal type.[2]

The data employed in preparing the distributions analyzed above cover a long period of years and have been combined in a variety of forms. They furnish fairly conclusive evidence concerning the form which frequency distributions of price relatives take. It is clear that the conditions which give rise to the normal distribution are seldom realized in the system of prices, in so far as degree of change in price between specific dates is concerned. The factors affecting such changes in individual commodity prices are not independent and indefinitely great in number. (Or if they are unrestricted in number, it would appear that a limited number are of dominant importance.) Nor does each cause group affecting the items in a given distribution contribute with equal frequency results in excess and in defect of its mean contribution.

The majority of distributions of price relatives are of Type IV of Pearson's classification. Almost one-quarter of the total number are of other types, however. And of those which are classed as Type IV, many are represented by points in the heterotypic area. Almost half of the total number of distributions (90 out of 190) are, in fact, heterotypic.[1] It is certain that there is no one ideal frequency type to which distributions of price relatives conform.

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[1] As was noted, this test relates specifically to the hypothesis that the populations sampled are distributed according to the Gaussian law. It does not test whether, from the actual populations, individual samples following the normal law might not be secured. In the case of all distributions represented by points in the heterotypic area there is some possibility of securing individual samples following the normal law because of the infinite probable error of β_2.

[2] In commenting upon the peakedness of distributions of price relatives, to which attention was called by Wesley C. Mitchell, Frederick R. Macaulay has pointed out that this tendency toward heavy concentration is a result of the characteristic inertia of prices (*American Economic Review*, March, 1916, p. 205). This peakedness, which is present in a significant degree in all but 24 of the 190 distributions studied, appears to be a resultant of two factors—the inertia of some prices, of which Dr. Macaulay speaks, and a relatively high degree of variability of certain other prices. The extreme changes of the latter group give the distribution as a whole a degree of variability not consistent (in terms of a normal distribution) with the stability of the former group.

If we look upon price relatives, irrespective of the years to which they relate, as a single population, they must be classed as of an erratic and extremely unstable type. And if relatives for successive years be regarded as constituting separate populations, these populations appear to differ so radically from each other that they cannot be considered as belonging to a single homogeneous family. This is not to say that comparison of measures relating to different years may not be very significant. It is merely to say that we do not have here a stable, homogeneous population, as such populations are found in handling many types of statistical data in biology, economics and other scientific fields.[2]

Although no pronounced change in frequency type is effected by changing the form of price relatives (i. e., from natural to logarithmic) before combining them, by using weights, or by employing link in preference to fixed base relatives, or vice versa, there is evidence that something is gained in the way of statistical accuracy by such modifications of method. There is some apparent improvement in stability of type and in the efficiency of the orthodox descriptive measures when logarithms of price relatives are used, in place of relatives in natural form, when weights are employed, and when link relatives rather than fixed base relatives are combined.[3]

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[1] If a distribution falls in the heterotypic area it means that the fourth moment has an infinite probable error. Truman L. Kelley answers the question as to how a distribution of price relatives could have an infinite feature by pointing out that certain commodities for sale in 1917 were not purchasable at any price in 1918. The population of 1918 price relatives, on the 1917 base, did, therefore, contain infinite ratios. The infinite characteristic of the actual distribution studied as a sample is evidence of the possibility of such infinite ratios (*Statistical Method*, p. 146).

Kelley argues that the instability of distributions departing from the normal type (or from Types III or V) is an instability inherent in the data, not a mere oddity of the equations representing the various distribution types.

[2] Striking evidence of this is found in the extraordinarily high values of β_1 and β_2 which were secured from some of the price distributions. A number of these exceed the highest values of these criteria previously observed. Pearson (*Phil. Trans.*, Vol. 216-A, p. 440) cites as the highest observed values of β_1 and β_2, of which he has heard, those given by Duncker (*Biometrika*, Vol. VIII, p. 238). These are

Armzahl, *Asterina exigua* ($N=600$) $\beta_1=1.76$, $\beta_2=33.13$
Armzahl, *Archaster typicus* ($N=902$) $\beta_1=4.76$, $\beta_2=128.48$

[3] These statements have to do only with the question of distribution type. Many other considerations, some of which have been touched upon in earlier sections, bear upon the choice of methods in particular cases. It will be observed that in following chronological changes in type in the succeeding section use has been made of unweighted relatives in natural form, as well as of weighted logarithms of relatives.

§On the Form of Frequency Distributions of Price Relatives

There are many statements in the literature on index numbers concerning the type of frequency distribution secured when price relatives are combined. F. Y. Edgeworth, in his *Memoranda* on "Measurement of Change in the Value of Money" (1887-1889) referred to the asymmetrical character of many distributions of price relatives, in natural form, and suggested that the Galton-Macalister curve (the equation to which gives a normal distribution when the logarithms of x-values are taken) might be used to represent such distributions. (See *Papers Relating to Political Economy*, Vol. I, p. 242.) Edgeworth states, however, that this asymmetry is not found in all distributions of price relatives, and that price relatives in natural form would be expected to combine in the form of a normal distribution "where the entries are average prices based on a great number of items."

Wesley C. Mitchell made a detailed comparison of the actual distribution of 5578 link relatives (drawn from different years) and the corresponding normal distribution. (*The Making and Using of Index Numbers*, *Bulletin* 284, *Wholesale Price Series*, U. S. Bureau of Labor Statistics, pp. 18-19.) He finds, in the first place, the asymmetry noted by Edgeworth, and suggests that the use of a logarithmic x-scale would result in a more symmetrical distribution. Even more pronounced, however, was the difference noted by Mitchell between the actual and the normal distributions in respect to peakedness. The actual distribution was much more peaked than the normal. The results of the present study indicate that this leptokurtic distribution is characteristic of price relatives, an even more consistent characteristic than is the positive skewness.

A. W. Flux has suggested the possibility of a study of the changing shapes of distributions of price relatives, and has touched upon the probable form of such distributions. Speaking of twelve-month link relatives, he says "If the quotations are sufficiently independent, the distribution of the 150 variations should, when the general price level is stable, accord with the well-known law of error. If prices are rising the curve showing the 'scatter' of the different price movements should take a skew form with its mode to the right of the mean, and if they are falling the mode should be to the left of the mean." ("The Measurement of Price Changes," *Journal of the Royal Statistical Society*, Vol. 84, 1921, p. 190.) The first condition, that the quotations should be sufficiently independent, is one which would be difficult to ensure in practice. It is possible that the distribution of a selected group of price relatives, picked out on the basis of independence, might accord with the normal law when the price level was stable. In such a selection of prices as is employed in the computation of most index numbers some degree of intercorrelation is to be expected. (Professor Bowley's results have indicated the degree of correlation prevailing in a typical group.) For such a group a close approach to the normal law appears to occur very rarely, even with a stable price level.

The discussion in the succeeding sections bears upon the further suggestions of Mr. Flux concerning the character of the skewness to be expected with rising and falling prices. There appear to be some exceptions to the relations he suggests, since all phases of rising (or of falling) prices are not identical in respect to the nature of the changes in the constituent items.

Lucien March, using the data referred to at an earlier point, tests the conformity of distributions of relatives computed from French, English and American prices to the normal law, He compares the relative frequencies of the actual observations falling within stated limits, measured from the mean, with corresponding frequencies for a normal distribution. (For Professor March's results see *Metron*, Vol. I, No. 4, 1921, pp. 82-3.) He concludes, "Quant à la distribution de ces écarts suivant leur grandeur, on voit. . . . . . . .qu'elle se conforme d'une manière relativement satisfaisante à la loi normale." No rigorous test of the significance of the observed differences is applied, presumably because, for Professor March's purposes, a very rough agreement was satisfactory. In the absence of a test more precise than that applied this does not constitute evidence of conformity to the normal law. In comparing the normal and actual frequencies, positive and negative deviations are lumped, and the comparison is solely in terms of the magnitude of the deviations. Since Professor March has shown, in another table, that his distributions are asymmetrical (the percentage of cases above the mean varying from 32 to 58 in the six distributions he studied) it is not valid, for general purposes, to test conformity to the normal law in terms of the magnitude of the deviations alone. Professor March's conclusion, it should be noted, is applied by him only to the magnitude of the deviations.

Corrado Gini ("Quelques considérations au sujet de la construction des nombres indices des prix et des questions analogues," *Metron*, Vol. IV, No. I, 1924) reviews various pieces of evidence on this subject. Though he recognizes the claims of various authorities that price variations follow the normal law, he contends that this conformity is not always found. The present investigation justifies the broader statement that distributions of price relatives very seldom conform to the normal law.[1]

3. CHRONOLOGICAL CHANGES IN THE CHARACTERISTICS OF FREQUENCY DISTRIBUTIONS OF PRICE RELATIVES

In the preceding section various distributions of price relatives have been compared in respect to those characteristics which define population type. From the charts which have been presented it is clear that, for any given type of distribution, these characteristics change materially from year to year. It remains to inquire as to whether these changes possess significance, for the purposes of the present investigation.

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[1] The book by Dr. Maurice Olivier (*Les Nombres Indices de la Variation des Prix*) to which previous reference has been made contains the results of a comprehensive study of the form of distributions of price relatives in France, between 1920 and 1924. The data are relatives on the 1913 base, computed from the price series entering into the French wholesale price index of the Federal Reserve Board. Dr. Olivier finds that the distributions of these price relatives in natural form are far removed from the normal type. Distributions of logarithms of these relatives are closer to the Gaussian form, but remain distinctly more peaked than the normal curve (pp. 98-154).

Frequency distributions of price relatives may change from year to year in respect to any one, or all, of their characteristics. The central tendency may change—and variations of this type furnish the subject matter of the extensive literature on index numbers of prices. There may be changes in the degree of dispersion, a topic which has been treated in some detail in a preceding section of this volume. The characteristics with which we are now concerned are those relating to population type. These characteristics are defined by the specific measures of skewness and kurtosis and by the several criteria of curve type which have already been described. In the following pages we shall trace the year-to-year changes in these characteristics for two distribution types.

§Changes in the Characteristics of Frequency Distributions of Unweighted Fixed Base Relatives

This discussion may be introduced by a brief statement concerning the interpretation of several of the measures employed. The direction and degree of skewness of a distribution of price relatives for a given year is of considerable importance, particularly when considered in connection with the nature of the change in the level of prices between two dates. The skewness is negative, of course, when the tail of the distribution extends to the left, when low relatives occur more frequently than corresponding high ones. The mean, in such a case, is less than the median in value. With positive skewness the tail extends to the right, high relatives occur more frequently than corresponding low ones, and the mean exceeds the median in value. This measure has significance, for our present purpose, because of the light it throws on the nature of a given change in the level of prices between given dates.

When the skewness is zero with rising prices it means that the advance has been a perfectly symmetrical one, that there has been an upward movement of the bulk of commodities, and that high and low price relatives representing a given deviation from the mean occur with the same frequency. Thus in 1908 the arithmetic average of unweighted relatives of prices, on the 1902 base, was 106.8. The skewness was zero (within sampling limits). We may take this to mean that the advance between 1902 and 1908 had been a perfectly balanced one. The dispersion was considerable, but the distribution of the relatives about the central tendency was symmetrical. A balanced and symmetrical price decline is measured in the same way. Thus in 1894 the arithmetic average of unweighted relatives on the 1891 base was 85.7 and the skewness was zero.

Positive skewness with rising prices means an unbalanced advance, in the sense that a few commodities have risen materially and that the bulk of commodities have lagged behind. This was the situation, in respect to fixed base relatives (1902 base), in 1907. Negative skewness with rising prices means an unbalanced advance of another type, with the bulk of commodities rising, but with a small number falling materially, or lagging behind on the advance. Some will always lag, of course, but the condition mentioned means that the number which lag exceeds the number which lead by corresponding amounts in the price advance. In 1910 such a situation prevailed among relatives on the 1902 base.

Positive skewness with falling prices represents a condition in which the bulk of commodities have moved downward, but a few have risen in price (or have fallen less than the rest). In 1895 price relatives on the 1891 base made up a distribution having this characteristic. Negative skewness develops with falling prices when a few commodities have fallen materially, with no corresponding increases, and with the bulk of articles not falling, or lagging behind the few on the decline. The 1893 distribution of relatives on the 1891 base portrays a condition of this type. The widely different conditions which may accompany a price rise (or a price fall) should be distinguished, if a clear understanding of the price situation is to be obtained.

The measure of kurtosis indicates the shape of a given distribution in another respect. If the concentration at the central tendency is greater than in the corresponding normal distribution, with a smaller concentration at the shoulders of the curve and a wider spread at the tails, this measure is positive in value. If the central concentration is less than in the corresponding normal distribution, the measure of kurtosis is negative. The measure is positive, in general, for distributions of price relatives.

The story of the year-to-year changes in type of the distributions of price relatives is not a simple one for, as has been suggested above, we are dealing with a population which seems to contain inherent elements of instability. This population is subject to violent internal changes which are reflected in radical alterations from year to year in the form and character of the frequency distributions. Yet there is some order in these fluctuations, and information of some value concerning changes in the price system from year to year may be gleaned from a study of these alterations in type.

It is desirable to follow in some detail the changes in distributions composed of both fixed base and link relatives. The distributions which have been analyzed for the entire period since 1890 represent combinations of unweighted and weighted fixed base relatives, in natural form and unweighted and weighted link relatives, in logarithmic form. Those which will be discussed here are the unweighted fixed base distributions, and the weighted link distributions.[1]

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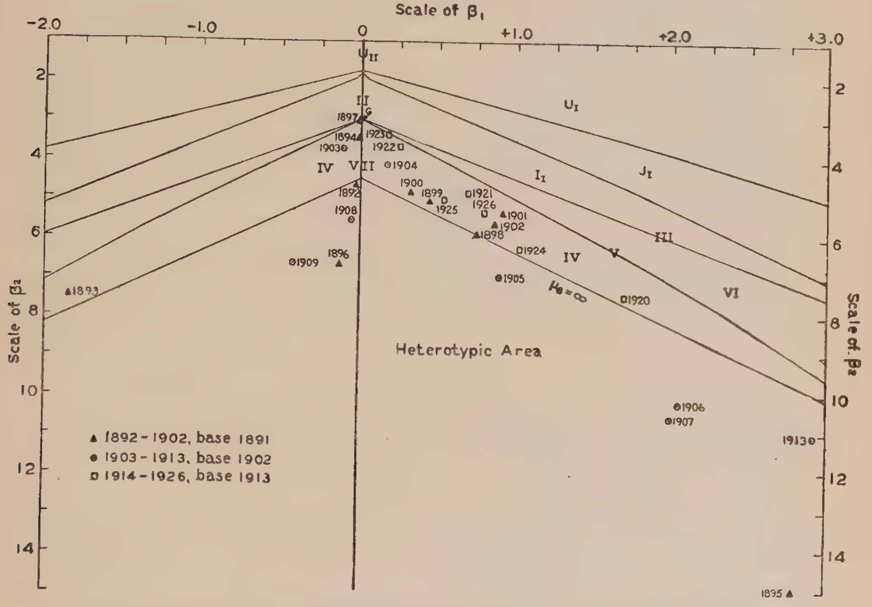
[1] The year-to-year changes in the criteria of curve type relating to the unweighted natural distributions seem to be more consistent and more significant than the changes in the corresponding weighted measures. Although measures computed from weighted relatives would in general be preferred, certain of the annual changes in criteria of curve

FIGURE 43

THE POPULATION OF PRICES.

Diagram Showing the Location of Points Representing Distributions of Unweighted Fixed Base Relatives in Natural Form, 1892-1926.[1]



[1] The relatives which were combined in forming these distributions fall into the three groups distinguished by the legend.

The points representing distributions for the following years fall beyond the limits of the chart:

Year	β_1	β_2
1910	—5.9280	18.9393
1911	13.6001	31.5601
1912	15.0925	33.2958
1914	8.9019	23.5430
1915	118.4667	139.3550
1916	164.2497	200.3467
1917	147.4448	192.4489
1918	126.6821	148.1861
1919	29.6149	68.2365

Fixed base relatives have been computed for three different periods, so that it is possible to study their behavior, in combination, under

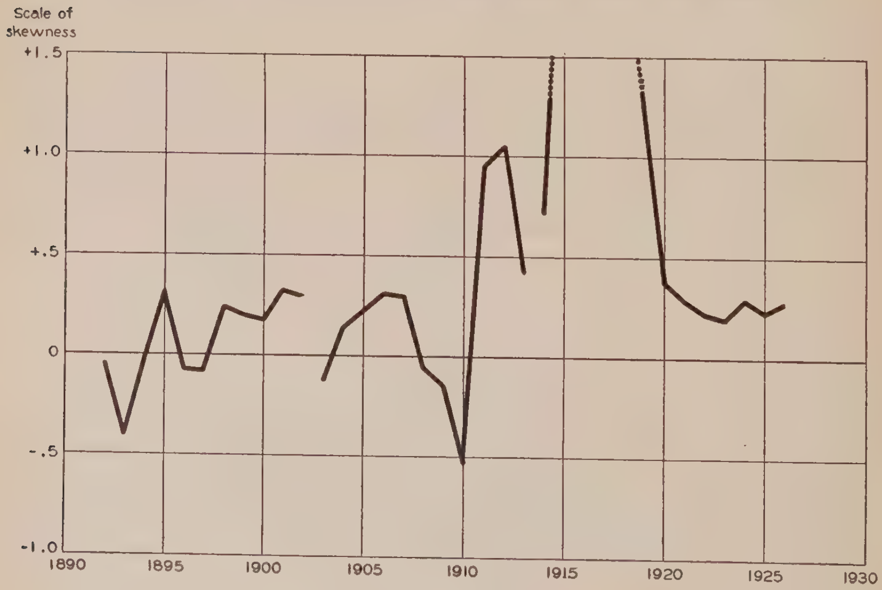
type for this group appear to be more erratic than those of the unweighted relatives. This is probably due in general to wide price fluctuations of one or two heavily weighted articles. Extreme price increases would be given heavy weight, in any case, in arithmetic distributions, and this tendency is intensified when widely varying weights are employed and when the higher moments are involved in the calculations. The use of logarithms gives less weight to high relatives, and permits advantage to be taken of weights without introducing the erratic movements that may be present when natural numbers are weighted. The differences between weighted and unweighted distributions are not extreme, however.

The statement that the year-to-year changes in type of weighted natural distributions may be erratic does not mean that they may be extreme (in comparison with unweighted distributions). They appear at times to be accidental, inconsistent with previous movements, and are apparently the reflection of extreme movements in the prices of a few commodities. For this reason they may not have great economic significance markedly different conditions. The first part of the first period, 1891-1896, was marked by falling prices and generally depressed industrial conditions. This was followed by recovery and a pronounced price rise during the later years. The second period, 1902-1913, was characterized by a sustained rise in the price level, broken by two short periods of price decline. The third period, 1913-1926, covers the price revolution of the war and post-war years.

The changes in the character of distributions of unweighted fixed base relatives may be followed on Figure 43, which shows the location by years, of the points defined by the values of β_1 and β_2. Since the chronological changes are difficult to follow on these charts, the information which they yield is presented, in a slightly different form, in Figures 44 to 46. Departures from the normal type due to the lack of symmetry[1] of the successive distributions are shown in Figure 44. The movements of the measure of skewness above and below the zero line trace the year-to-year fluctuations of the points plotted in Figure 43 as they swing to the right and left of the axis of symmetry. The next chart (Figure 45) traces variations in the degree of peakedness[2] of the dis-

FIGURE 44

Measures of Skewness of Distributions of Unweighted Fixed Base Relatives in Natural Form, 1892-1926.



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[1] Pearson's measure of skewness $\dfrac{\sqrt{\beta_1}\,(\beta_2 + 3)}{2\,(5\beta_2 - 6\beta_1 - 9)}$ has been employed.

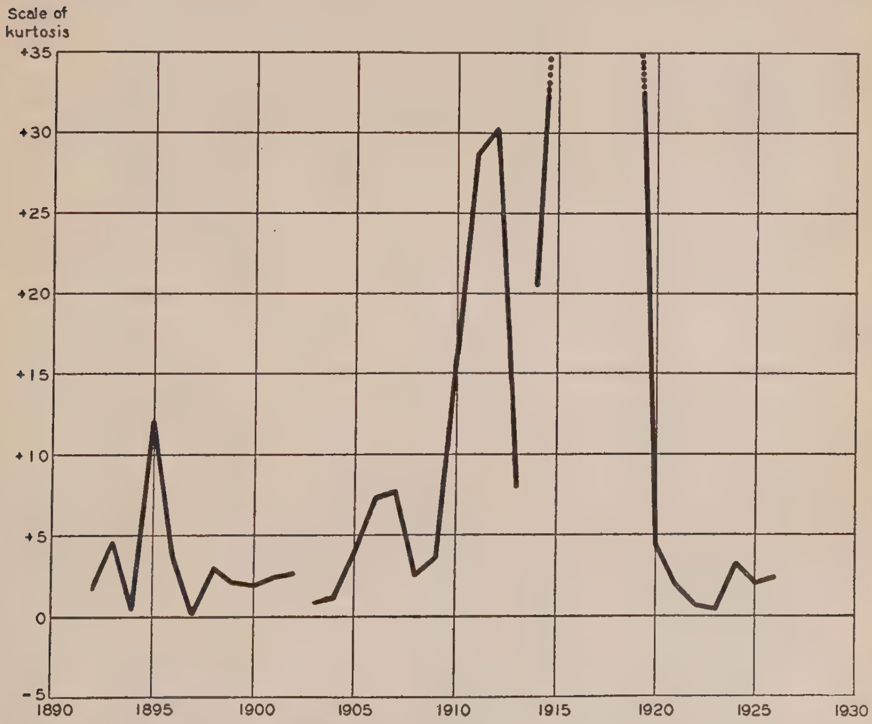
[2] As measured by $\beta_2 - 3$.

tributions of fixed base relatives in natural form. These two figures (44 and 45) thus reflect deviations from the normal type in the two basic respects in which distributions may vary from the Gaussian form. The criterion κ_1, which measures degree of departure from Type III, is plotted in Figure 46. Type III, it will be recalled, includes those stable frequency distributions for which all positive moments are finite. In tracing the fluctuations from year to year of the several measures just discussed, concurrent changes in the central tendency and in the dispersion may be noted. These measures are given in Appendix Table XIX.

Following in Figure 43 the movements of the Beta points representing the various annual distributions, and tracing the year-to-year changes in skewness and kurtosis, we have a story of recurrent swings away from and back to a balanced condition of symmetry and stability.

FIGURE 45

Measures of Kurtosis of Distributions of Unweighted Fixed Base Relatives in Natural Form, 1892-1926.

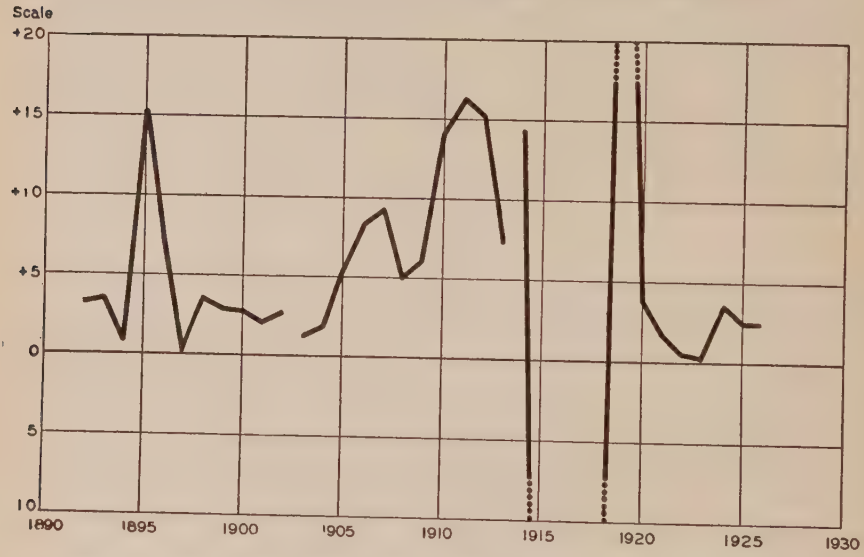


In the first period (1891-1902) there are two such swings, and in the second period (1902-1913) there are also two. During the period from 1913 to 1926 there is one broad swing. The movements correspond in general to the major cycles in business.

The observations for the first period begin with the distribution for 1892. From 1891 to 1892 there had been a balanced decline in average prices. Although there was no material change in the price level between 1892 and 1893 there was a relatively severe internal disturbance. The distribution in 1893 of 1891 base relatives is sharply skewed in a negative direction, and the Beta point is pulled far away from the Gaussian point. It will be recalled that 1893 was a year of panic and depression.

FIGURE 46

VALUES OF THE CRITERION κ_1 FOR DISTRIBUTIONS OF UNWEIGHTED FIXED BASE RELATIVES IN NATURAL FORM, 1892-1926.



Between 1893 and 1894 there was a material price decline, but it was one which brought a return to symmetry in the form of the frequency distribution and a close approach to stability. The distribution of fixed base relatives in 1894 is, within the limits of random sampling, of the Gaussian type. By 1894, it appears, the effects of the sharp disruptions of 1893 had been repaired. In 1895 there came another violent disturbance, but this time the skewness is positive. The Beta point in Figure 43 is carried far to the right of the axis of symmetry and into the heterotypic area. (1895 was a year of sharp price rise, and a sharper fall. The net change in the price level, as compared with 1894, was negligible, but the characteristics of the frequency distribution underwent a great change.) Symmetry and balance were restored in 1896 and 1897, the years which marked the lowest point of the price drop of the 1890's. The distribution for 1897 is one of the few definitely Gaussian distributions found. The general price advance which began after that date brought five successive distributions, (for the years 1898 to 1902) which are clustered in a small area slightly to the right of the axis of symmetry. All are somewhat skewed in a positive direction, but there are no extreme irregularities in these distributions. The year 1900, during which a minor recession set in, is closest to the axis of symmetry.

The second period, which covers the years 1902-1913 (the relatives being on the 1902 base), witnesses a similar series of swings away from the axis of symmetry, the swings culminating in 1906-07 and in 1911-12. The period starts with a negatively skewed distribution in 1903. For the four years following the skewness is positive, reaching its maximum in 1906. The changes in respect to symmetry were accompanied by increases in the degree of peakedness of the distributions, and by a constantly greater departure from the Gaussian point. That is, during this four year period there was an unbalanced upward movement of prices, with a few extreme advances extending the tails of the distributions to the right.[1] The distributions of 1906 and 1907 are clearly heterotypic. With the depression of 1908 came a swing back to symmetry. There is a distribution of slight negative skewness for 1909, and 1910 is more sharply skewed in the same direction. Following that there was another sustained swing to the right, with a succession of asymmetrical distributions, deep in the heterotypic area. Not until 1913 was there another movement in the direction of symmetry, and this did not carry all the way back. In these years (1911, 1912, 1913) the bulk of the commodities lagged behind the few in the advances that had been made since the base year (1902).

During the third period (1913-1926, 1913 being the base) there was a single major swing away from and back to the axis of symmetry. The distributions of fixed base relatives are positively skewed in all years. This means that for this entire period there is a preponderance of frequencies above the central tendency (in the sense that extremely high relatives occur more frequently than corresponding low ones). The degree of asymmetry varies materially, however, for different years, and the degree of departure from the Gaussian point varies even more widely. The swing away from symmetry and stability began in 1914, reaching a maximum in 1916. The chief characteristic of the distributions for 1915 and 1916 is the extreme elongation of the tails extending to the right, which means that the bulk of commodities lagged far behind on the rise. During the years 1917, 1918, and 1919 a tendency to correct this lack of proportion is in evidence. The bulk of the commodities moved up, and the most extreme departures were reduced in magnitude. The distributions remain skewed and unbalanced, however, to a degree never approached during the other years of the period covered.

The changes in the character of distributions of price relatives which occurred between 1916 and 1923 are of exceptional interest, and for this

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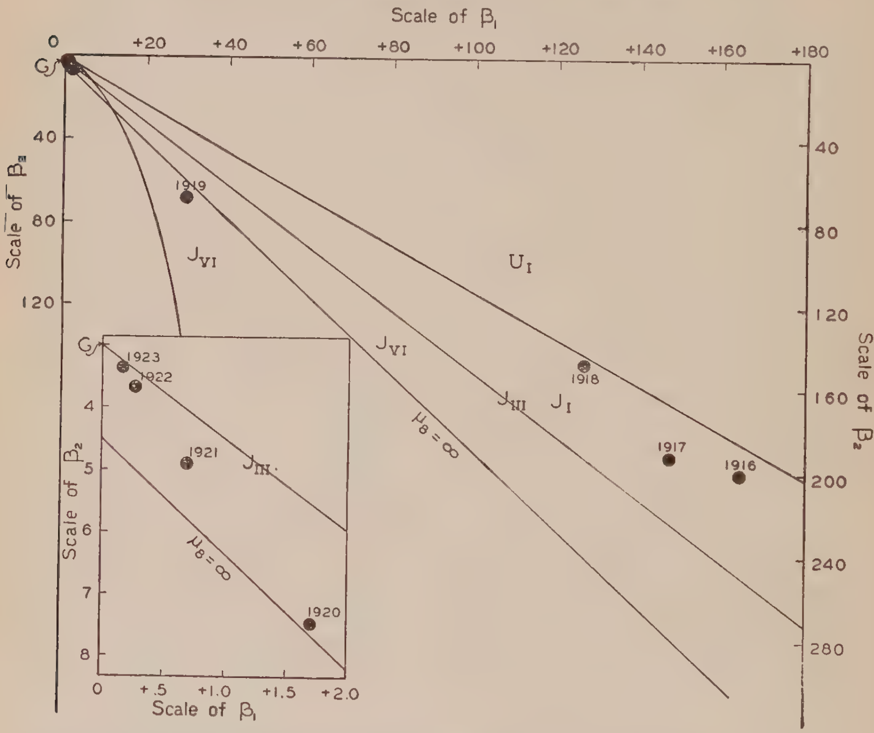
[1] A distribution may depart widely from the Gaussian type because of the influence of one or two extreme price changes. This is notably true of the distribution relating to the year 1915. One should be cautious in basing conclusions upon changes in type due to the influence of a small minority of the observations, but it is a fact of great significance that price distributions are materially affected by a few divergent observations, and that such divergencies may occur among apparently homogeneous data.

FIGURE 47

THE MOVEMENT TOWARD PRICE EQUILIBRIUM, 1916-1923.

Diagram Showing the Location of Points Representing Distributions of Unweighted Fixed Base Relatives in Natural Form[1].



The insert in the lower left hand corner, which is an enlargement of that portion of the main diagram in the neighborhood of the Gaussian point, shows the changes between 1920 and 1923.

[1] Base of relatives: 1913.

reason the points representing these distributions are shown in Figure 47, on scales which permit the whole movement to be followed. By 1916, as has been noted, the swing away from the axis of symmetry had attained its peak. During the seven years between 1916 and 1923 there was an unbroken movement back toward the normal type of distribution. In 1917 and 1918 this movement was not pronounced; 1919 brought an acceleration of this return, though the distribution for that year is still sharply skewed in a positive direction. The year 1920 marks an equally pronounced regression toward the normal type. The points representing the distributions for 1920, 1921, 1922 and 1923 appear in the insert in Figure 47, in which the scales have been enlarged. These four points lie practically on a radial line from the Gaussian point, and come progressively closer to it. A normal curve could be employed to describe the distribution for 1923. (The distribution in 1923 of weighted relatives on the 1913 base gives an almost perfect Gaussian distribution.) The dispersion is wide, as may be seen by reference to the frequency distribution itself (Figure 21), but it gives evidence of being the resultant of a balanced play of forces. The distribution for 1922 is very close in type to the 1923 distribution. By 1922, we may say, the distortion and the disturbed conditions which the price revolution of the war and immediate post-war years had brought had been in large part corrected. The various forces which were acting upon the 1913 base relatives had by that year become so numerous and so well-balanced that their interaction was able to bring about that orderly distribution to which the name of Gauss has been attached.

It is a curious and dramatic thing, this march of the successive Beta points back to the Gaussian point, as the conditions of balance and independence and multiplicity of causal factors which are characteristic of the normal law, and which had been so markedly absent during the war years, were gradually re-attained in the price system. It exemplifies in striking fashion the emergence out of chaos of that form of order which the play of sheer chance brings. Here is nature forming habits.

The years 1924 to 1926 brought a minor swing away from the axis of symmetry in the direction of positive skewness. The points representing distributions for these years are within or close to the little circle within which lie the points for the five years of slowly rising prices and of comparative quiet between 1898 and 1902. The later distributions are of the same basic type as these earlier ones.

The conclusions concerning this tendency of distributions of fixed base relatives to recover from the disturbances attendant upon extreme price changes have been checked by a study of distributions of unweighted relatives on the 1891 base (in natural form) carried forward through 1926. The number of commodities included was 195 for the entire period (except for 1918 and 1925, in which prices for only 194 were available, and 1926, for which 193 were included). The descriptive measures are given in Appendix Table XXVII.[1]

During the decade prior to the war the distributions of relatives on the 1891 base differ in the details of their movements from the distributions of relatives on the 1902 base. The positive skewness is somewhat more pronounced, and the recession of 1908 does not bring the return to symmetry which it did for the distributions on the later base. Not until 1909 did the points representing distributions on the 1891 base swing back toward the axis of symmetry. During the war and post-war years, however, we find the distributions of 1891 base relatives following much the same course as the distributions on the 1913 base, although the disturbances of the war years had less marked effects on the relatives resting on the distant base. The price changes of 1915 to 1918 brought the same series of positively skewed distributions, and the years 1920 to

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[1] The fact that the number of observations upon which these distributions are based is smaller for the period since 1913 than the number included in the distributions on the 1913 base renders the criteria of curve type somewhat less reliable, i. e. subject to greater sampling fluctuations.

1923 witnessed the same pronounced movement back toward symmetry and stability. In this case the movement did not carry as far back toward the normal type. It is noteworthy, however, that the distributions for 1921, 1922, 1923 and 1924 are, within the limits of sampling, of Type III. This type may be considered to stand next to the Gaussian in respect to stability. It is the form of distribution which arises when, in Pearson's terms, "each cause group is of equal valency and independent, but does not give contributions in excess and defect (of the mean) of equal frequency." It appears from this evidence that the factors which from 1921 to 1924 shaped the distribution of relatives on the 1891 base were numerous (or, if limited in number, were of equal importance) and independent. The conditions affecting these distributions differed from those which bring about a normal distribution in that the contributions of individual factors above and below their mean contribution did not tend to be of equal frequency. One important result of the price changes during the thirty years which had elapsed since the base year was the excess of contributions above the mean, giving the positive skewness which has been noted. But, in spite of this, the elements of instability (represented by infinite positive moments) which appear in most distributions of price relatives are not present in these four distributions. (Type III distributions, to which these approximate, are characterized by finite positive moments of all degree.) It may be hazarded that this curious re-appearance of stability of type after thirty years, during which violent price disturbances took place, is due to an increase in the number of factors affecting the prices of the commodities studied, a corresponding decline in the importance of a limited number of factors which may at times have exerted a preponderant influence, and a decline in the strength of the varied intercorrelations between factors. The mere passage of time might be expected to bring about just such changes as these, and the evidence furnished by the various fixed base distributions which have been analyzed indicates that such a tendency is clearly present.

But it is not a permanent condition of stability which is thus brought about. Just as the distributions of relatives on the 1913 base swing away from the normal type after 1923, so the distributions of 1891 base relatives depart from the type which had prevailed during the four years from 1921 to 1924. The business and price developments of 1925 and 1926 introduced new factors, and distribution types deviating widely from the Gaussian and from Type III again appeared. But, if the history of past changes is repeated, time will bring further corrections, disruptive elements will be eliminated, or balanced, and there will be a new movement in the direction of the stable frequency types.

§ Changes in the Characteristics of Frequency Distributions of Weighted Link Relatives

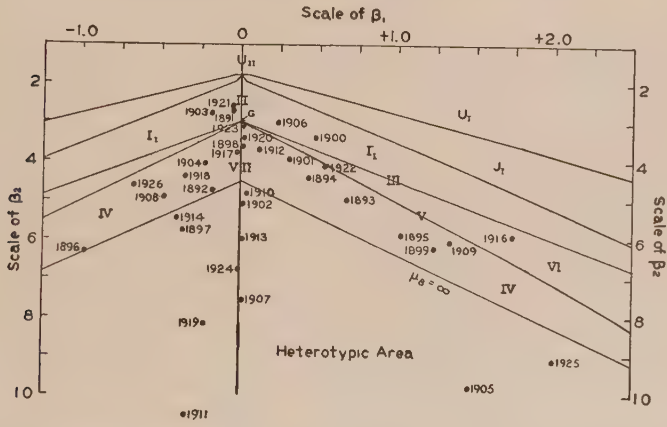
Figure 48, shows the changes in the location of the points representing distributions of weighted logarithms of link relatives of wholesale prices, as these points are defined by successive values of β_1 and β_2.

Changes in skewness, kurtosis and stability (as measured by κ_1) may be followed on Figures 49 to 51.

FIGURE 48

THE POPULATION OF PRICES.

Diagram Showing the Location of Points Representing Distributions of Weighted Link Relatives in Logarithmic Form, 1891-1926[1].



[1] The point representing the distribution for 1915 falls beyond the limits of the chart. The values of the criteria are:

$$\beta_1 = 3.7787$$
$$\beta_2 = 20.2149$$

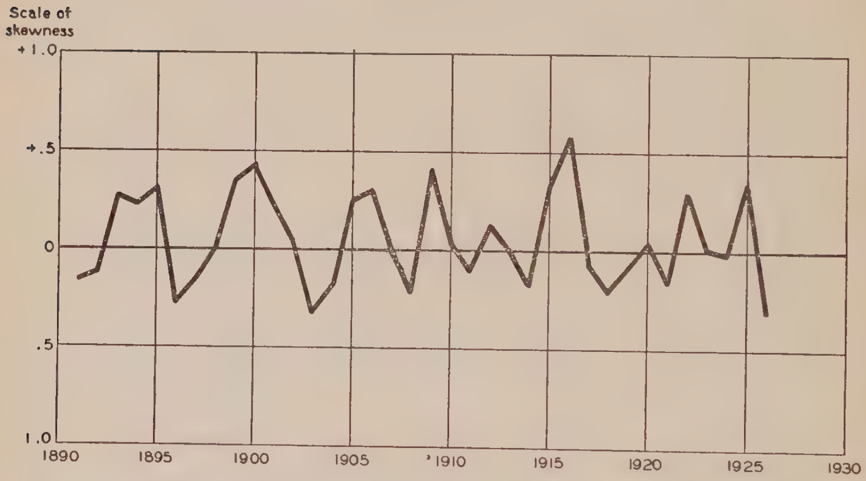
Variations from year to year in the characteristics of distributions of link relatives are, as might be expected, somewhat more pronounced than the variations in the form of distributions of fixed base relatives. Nevertheless, a series of cyclical swings away from and back to the axis of symmetry is discernible in these fluctuations. These swings may be followed most readily in the varying values of the measure of skewness (Figure 49). Tracing these values, for distributions of weighted logarithms of link relatives, we find a series of peaks in the direction of positive skewness in the years 1893-95, 1899-1900, 1905-06, 1909, 1912, 1915-16, 1922, and 1925. The valleys (i. e. conditions of negative skewness) come in the years 1891, 1896, 1897, 1903-04, 1908, 1911, 1914, 1918, 1921 and 1926. The years of approximate symmetry are 1898, 1902, 1907, 1910, 1913, 1917, 1920, 1923, 1924.

If we start with the depression of 1896 there is observable a fairly consistent relationship between the direction and degree of skewness on the one hand and the changes in business activity on the other. The years of pronounced positive skewness are, in general, the years when the tide of business was running steadily in the direction of prosperity, with no material movement in the other direction. This is true of the years

1899, 1905 and 1906, 1909, 1912, 1915-16, 1922 and 1925. (The present evidence places 1900 in this group, although the annals of business show a mild recession in this year.) These are the years when the Beta points were pulled farthest to the right, away from the axis of symmetry[1].

FIGURE 49

Measures of Skewness of Distributions of Weighted Logarithms of Link Relatives, 1891-1926.



Distributions which are sharply skewed in a negative direction (i. e. with tails extending to the left) are found, in general, in years in which the tide of business activity was receding, or at its lowest point preceding revival. Such conditions prevailed in 1896 and 1897, in 1908, 1911, 1914 and 1921, years in which the Beta points representing weighted logarithms of link relatives in Figure 48 are pulled to the left of the axis of symmetry. In 1903, 1904 and 1918 distributions of the same type are found, and there is evidence in the records of business of similar tendencies in these years, although the tendencies were not pronounced. The negatively skewed distribution for 1926 reflects the general decline in prices during that year, a decline which was exceptional in that it was not coincident with any widespread recession in business.

When there are cross-currents in the business world or, more exactly, when the direction of movement changes in the course of the year, symmetrical distributions are secured. This is true of the distributions for 1902 (price index turned downward after October), 1907

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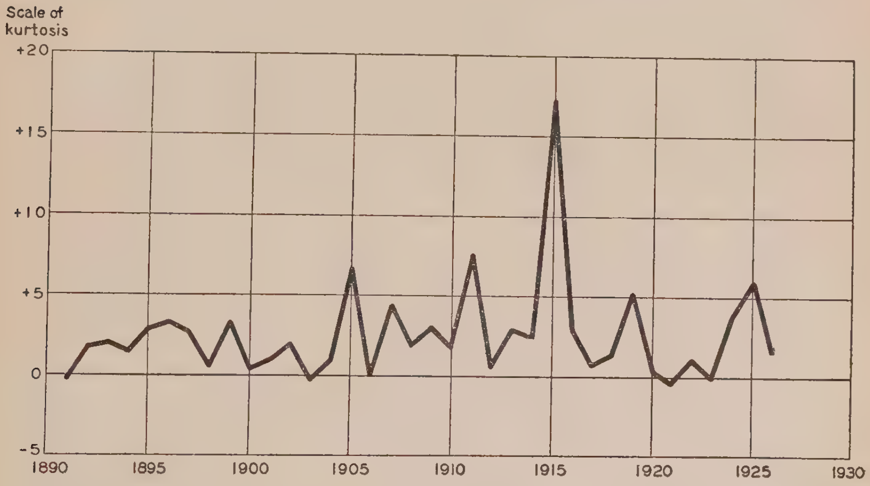
[1] Positive skewness means, in any case, that deviations above the central tendency exceed in number corresponding deviations below. When the distributions are logarithmic, the word "corresponding" is to be interpreted in terms of ratios (i. e. a deviation of 20 per cent below a given value is equivalent to a deviation of 25 per cent above). A given degree of positive skewness on the logarithmic scale represents, thus, a greater degree of skewness on the natural scale.

(price index turned downward after October), 1910 (price index turned downward after April), 1913 (price index turned downward after September), 1920 (price index turned downward after May), 1923 (price index turned downward after April), and 1924 (price index turned upward after June). All of these years except the last, it may be noted, are years during which prices turned downward. It is apparent that a downturn within a calendar year tends to produce that condition of balance among price relatives which is lacking when the tide of price change is running steadily up or down.[1]

FIGURE 50

Measures of Kurtosis of Distributions of Weighted Logarithms of Link Relatives, 1891-1926.



The dates mentioned above include all but two of those during which symmetrical distributions were obtained. The exceptions are 1898 and 1917. In each of these years the general price index was rising, but there were conflicting forces at work. In 1898 the effects of the preceding depression were still felt, and full-fledged prosperity had not yet arrived. In 1917 the flood of war-time advances was checked by federal price regulation, a factor which served, apparently, to produce the balance which ordinarily results from a turn in prices during the year.

In this discussion the years prior to 1896 have been omitted. The distributions of weighted logarithms of link relatives were negatively skewed in 1891 and 1892, and positively skewed in 1893, 1894 and 1895. Changes in distribution type during this disturbed five year period are not consistent with those noted for the later years, nor is there agreement between the changes in form of weighted and unweighted distributions[1].

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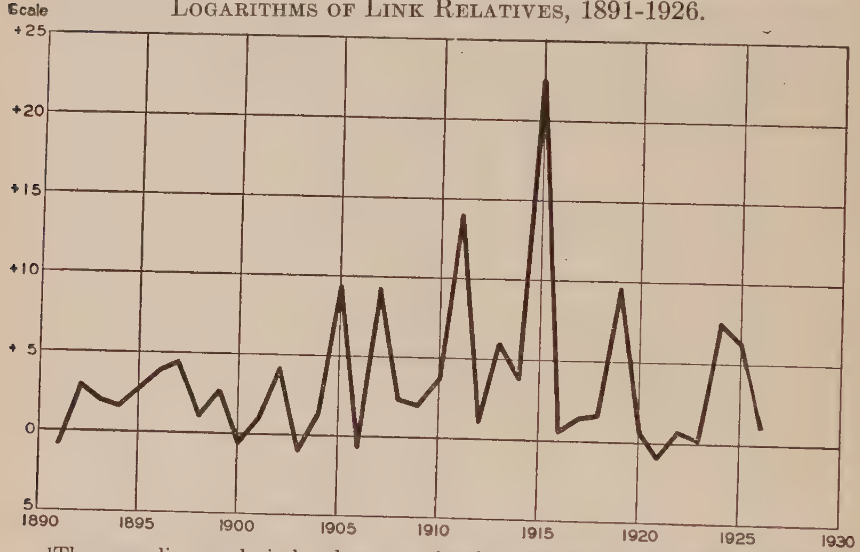
[1] The slight decline toward the end of 1925 was not sufficient to offset the pronounced positive skewness of the distribution of that year.

FIGURE 51

VALUES OF THE CRITERION κ_1 FOR DISTRIBUTIONS OF WEIGHTED LOGARITHMS OF LINK RELATIVES, 1891-1926.



[1] The preceding analysis has been restricted to distributions based upon average annual prices. It would be possible to obtain a more accurate account of the changes which frequency distributions of price relatives undergo if we used monthly instead of annual prices, but the labor involved is prohibitive. Monthly price relatives of any of three different types—fixed base relatives, link relatives on the month preceding as base, or link relatives on the twelfth month preceding as base—might be employed in such a study. Distributions of fixed base relatives, it may be expected, would have somewhat the same characteristics as distributions of annual averages, expressed as relatives on a fixed base, but changes in distribution type could be followed with more accuracy. Distributions of month-to-month link relatives would undoubtedly be very peaked (i. e. marked by heavy concentration at the central tendency), somewhat erratic in their changes and, it may be hazarded, would not be of great value in interpreting economic changes. Distributions of link relatives on the twelfth month preceding as base might well prove to be quite significant, if their changes were analyzed in detail. (The utility of measures of changes in the price level, in dispersion, and in displacement computed on this basis has been suggested in preceding sections.) Such distributions would doubtless resemble distributions of annual link relatives in their general characteristics, but should be more sensitive and more accurate indexes of economic change.

Some indication of the form which such distributions would take is furnished by the following figures, relating to distributions of monthly link relatives and twelve-month link relatives. Each of these distributions is composed of unweighted logarithms of relative prices.

Distribution of	N	Mean	Index of dispersion	β_1	β_2	Skewness	Kurtosis
Monthly link relatives (Dec. 1924, on Nov. 1924, as base)	388	102.4	3.5	1.3451	10.7808	+.218	7.78
Twelve-month link relatives (Dec. 1924, on Dec. 1923, as base)	389	103.7	13.2	.4554	3.9329	+.289	.93

The story of the chronological changes in the form of distributions of price relatives has been confined to two particular types of distributions (unweighted fixed base relatives in natural form, and weighted logarithms of link relatives). The following summary contains the chief conclusions to which a study of these changes leads.

1. Year-to-year changes in the form of distributions of fixed base relatives trace a series of swings away from and back to the axis of symmetry. Sharp rises and declines in prices, such as those which occurred in 1893, 1895, 1916 and 1917, distort these distributions and carry them far from the Gaussian type. These deviations may be in the direction of positive or negative skewness. With very rare exceptions they bring distributions more peaked than the normal. Swings away from the axis of symmetry are followed, in the history of price changes since 1890, by clear movements back toward a stable, symmetrical type of distribution, approaching in several instances the Gaussian type. Such returns to the normal (or to a symmetrical) type may come with falling prices, as in 1894 or 1897, or with rising prices, as in 1923 (i. e. falling or rising with reference to the base period). They appear to come when approximate stability has been attained, after a period of disturbance. The tendency of fixed base relatives to cluster in this relatively stable form after periods of violent change, during which extremely skewed and unstable distributions were formed, throws light on the nature of the forces affecting the system of prices, and on the character of their interaction. There is evidence here that after periods of disturbance in the price system there is a tendency toward a gradual restoration of the conditions of independence and multiplicity of causal factors which are necessary to the fulfillment of the normal law, or of the law which is realized in distributions of Type III. The stable types do not persist, year after year, but tend to recur after unstable types have been generated in times of disturbance.

   The clearly defined regression to the normal type between 1916 and 1923 (shown graphically in Figure 47) furnishes a striking illustration of the re-attainment of equilibrium in the price system after a violent disturbance.

2. Somewhat similar swings about the axis of symmetry are observable in the year-to-year changes in the distributions of link relatives in logarithmic form, but a rather different inter-

pretation of these movements is called for. In general, departures from symmetry in the direction of positive skewness are found in years during which business activity is steadily increasing, with few conflicting movements. Swings to the left of the axis of symmetry come in years of recession or of depression, years during which the forces of business reaction are in the ascendant. Symmetrical distributions appear to be characteristic of years during which there are reversals of business and price trends.

3. Distributions of the normal type are somewhat exceptional, but approximations to such distributions are found under conditions which may be defined with some degree of precision. These conditions are not the same for fixed base and for link relatives. Distributions of fixed base relatives in natural form appear to approach the normal type periodically, these periodic returns following intervals of sharp disturbance. The forces which tend to form symmetrical distributions, which at times are of the Gaussian type, re-assert themselves after such disturbances. Among link relatives in logarithmic form that state of balance which leads to symmetrical distributions (and, in perfection, to the Gaussian distribution) is not the typical condition, but seems to arise during years marked by conflicting tendencies. When this balance between opposing forces is attained it is as a transitory condition, appearing to mark a passage from one type of distribution to another. The periodic recurrence of those distribution types which appear under conditions of equilibrium is of particular interest as illustrating a form of moving economic equilibrium.[1]
4. A distinguishing feature of distributions of price relatives is that they do not conform to any one type, but undergo marked changes with variations in price and business conditions. Most distributions of homogeneous data from biological, anthropological or other scientific fields, tend to conform to a common type, without sharp variations from sample to sample. Distributions of price relatives may be of the stable Gaussian type at one time; they may, at another date, be sharply peaked and badly skewed in a positive direction, lying deep in the hetero-

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[1] This equilibrium, which relates only to commodity prices and to relative changes in these prices, is not, of course, to be confused with the type of moving equilibrium dealt with by Professor Henry L. Moore, in his recent notable extension of the general theory of economic equilibrium ("A Theory of Economic Oscillations," *Quarterly Journal of Economics*, November, 1926).

typic area. Under other conditions we may find them equally distorted in the direction of negative skewness. The liability of such data to material changes from year to year in their group attributes is a fact of considerable economic importance.

Since frequency distributions of price relatives are subject to marked changes in type, the problem of sampling is a particularly difficult one. During years in which the universe of price relatives is distributed in accordance with the normal law, or years in which their distribution follows any fairly stable frequency type, successive samples may be expected to possess common group attributes, and to yield statistical constants differing but slightly in value from sample to sample. In other years, when the sample distributions fall within the heterotypic area, the evidence suggests that the universe of price relatives is highly unstable. In such cases there can be no assurance that successive samples would possess common group attributes, or that statistical constants derived from the higher moments would approach each other closely in value, when computed from different samples.[1]

VII Relations Among Measures of Price Instability

The various quantities described in the preceding pages have been presented as measures of different kinds of price instability. It remains to determine whether there are any consistent relationships among these measures. Some attention has been given in an earlier section to one phase of this question, the relation between changes in the price level and variations in the degree of dispersion of price relatives. Our present problem is the broader one of measuring relationships among all the measures relating to price stability, whether it be stability of the price level, stability of internal relations, or stability of distributions of price relatives in combination.

In the following tables certain of the results previously discussed are summarized, with additional measures relating to other factors than dispersion. The price indexes and the indexes of dispersion which are employed in the four tables immediately following have been computed from weighted logarithms of link relatives. In computing the coefficients in Table 114 the sign of the change in the price level has been retained.

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[1] The statistical constants commonly employed in studying price movements (the mean and the standard deviation) involve only the first and second moments. These are stable over a wider range than are the higher moments from which the criteria of curve type are derived, and are not subject to the same wide sampling fluctuations. Note should be made, however, of the limited validity of the first two moments for distributions of the J-type which have been found to occur occasionally among price relatives. (Cf. R. A. Fisher "On the Mathematical Foundation of Theoretical Statistics," *Phil. Trans. of the Royal Society of London*, Vol. 222, pp. 338-355.)

TABLE 114

CORRELATION COEFFICIENTS MEASURING THE RELATIONS BETWEEN CHANGES IN THE PRICE LEVEL AND OTHER GROUP MOVEMENTS OF PRICES

(1) Series correlated with percentage change in price level from year to year	(2) Period covered	(3) No. of observations	(4) Coefficient of correlation
Index of dispersion	1891–1926	36	+.02
Index of displacement (year-to-year displacement, fixed base relatives)	1893–1926	34	+.10
Criterion κ_1 (wtd. logarithms of link relatives)	1891–1926	36	—.07
Variability of prices, monthly data	1891–1925	35	+.37

These measures give no evidence of any relation between the dispersion of link relatives and changes in the price level, when account is taken of the direction of the change in prices, nor of any relation between the year-to-year displacement of fixed base relatives and changes in the price level. The criterion κ_1, which measures degree of departure from the stable Type III distribution, shows no significant relation to changes in the price level. The highest coefficient of correlation is that measuring the relation between the measures of monthly variability and the index of changes in the level of wholesale prices.

In computing the above measures account was taken of the direction of change in the price level. Employing measures of the degree of change, without sign, the results in Table 115 are secured.

We have here a distinctly higher set of coefficients than in the preceding table. The coefficient which measures the relations between price dispersion and changes in the price level is changed from +.02 to +.61 when the direction of change in the price level is ignored.[1] There appears to be, also, some relation between the degree of change in the price level and the amount of price displace-

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[1] See, however, the note on p. 364.

TABLE 115

CORRELATION COEFFICIENTS MEASURING THE RELATIONS BETWEEN CHANGES IN THE PRICE LEVEL (WITHOUT SIGN) AND OTHER GROUP MOVEMENTS OF PRICES

(1) Series correlated with percentage change in price level from year to year (without regard to sign)	(2) Period covered	(3) No. of observations	(4) Coefficient of correlation
Index of dispersion	1891–1926	36	+.61
Index of displacement (year-to-year displacement, fixed base relatives)	1893–1926	34	+.42
Criterion κ_1 (wtd. logarithms of link relatives)	1891–1926	36	—.21
Variability of prices, monthly data	1891–1925	35	+.69

ment, but the coefficient (+.42, based on 34 observations) is too low to indicate that price level changes are a material factor in causing price displacement. The criterion κ_1 shows a slight negative correlation with the index of price level changes, but the coefficient is not significant.

The above measures show a significant relationship between changes from year to year in the mean variability of individual commodity prices (measures of variability being computed from monthly prices) and corresponding changes in the level of wholesale prices. In securing this result account has been taken of those changes which occurred between 1915 and 1921, as well as of changes during earlier and later years. The coefficient is lowered materially if the study is restricted to pre-war years. Changes in the degree of variability of the prices of individual commodities seem to be closely associated with changes in the price level only during times of relatively violent change in the general level of prices. At a later point further reference is made to this subject.[1]

When the index of dispersion is correlated with the various other measures discussed we have the results given in Table 116.

The positive correlation between dispersion and displacement is to be expected. The sort of disturbance which produces a wide scatter of prices tends, also, to cause a shifting of price relations. If we accept κ_1 as a significant measure of group stability we may conclude, from this evidence, that the degree of price disper-

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[1] See pp. 374-376 and the footnote on p. 364.

TABLE 116

Correlation Coefficients Measuring the Relations between Price Dispersion and other Group Movements of Prices

(1) Series correlated with index of dispersion	(2) Period covered	(3) No. of observations	(4) Coefficient of correlation
Percentage change in price level (without regard to sign)	1891–1926	36	+.61
Index of displacement (year-to-year displacement, fixed base relatives)	1893–1926	34	+.63
Criterion κ_1 (wtd. logarithms of link relatives)	1891–1926	36	—.14
Variability of prices, monthly data	1891–1925	35	+.78

sion has no bearing upon group stability. The correlation between the measures of monthly variability and the index of dispersion is relatively high. The years which are marked by wide dispersion are characterized by a considerable movement of individual commodity prices within the year, a correspondence which is to be expected.

In the next table are summarized the results secured when the index of displacement is correlated with various other measures.

TABLE 117

Correlation Coefficients Measuring the Relations between Price Displacement and other Group Movements of Prices

(1) Series correlated with index of displacement (measuring the shifting from year to year of fixed base relatives)	(2) Period covered	(3) No. of observations	(4) Coefficient of correlation
Percentage change in price level (without regard to sign)	1893–1926	34	+.42
Index of dispersion	1893–1926	34	+.63
Criterion κ_1 (unwtd. fixed base relatives)	1893–1926	34	+.67
Variability of prices, monthly data	1893–1925	33	+.58

Certain of the above relations have already been commented upon. Some degree of correlation exists between the shifting of fixed base relatives and the instability of the distributions composed of such relatives, when instability is measured by κ_1. There is a suggestion here that the sort of disturbance which is reflected in a high value of the index of displacement tends to produce unstable frequency distributions. A relation such as that found between displacement of prices and monthly variability is to be expected, since a considerable movement of individual prices would tend to increase the degree of displacement.

The preceding discussion has been concerned with annual measures only. For the years 1920 to 1926 we have a set of monthly measures of price level movements, of dispersion, and of displacement. These measures, which represent changes over a twelve-month period, are shown in graphic form in Figures 34 and 41. It is apparent from an inspection of these graphs that there has been no consistent relationship between changes in the price level and changes in dispersion or displacement, if account be taken of the direction of change in the general price index. There appears to have been a negative relationship during the period of violent price change in 1920 and 1921, and a positive relation in subsequent years. Accordingly, in testing these relationships, the percentage change in the price level has been used without sign.

TABLE 118

Correlation Coefficients Measuring the Relations among Monthly Measures of the Group Movements of Prices

(1) Series correlated	(2) No. of observations	(3) Coefficient of correlation
Percentage change in price level, without sign, and index of dispersion, both computed from twelve-month link relatives for the period 1920-1926	84	+.80
Percentage change in price level, without sign, computed from twelve-month link relatives, and index of displacement of fixed base relatives over twelve-month period, for years 1920-1926	84	+.73
Index of dispersion, twelve-month link relatives, and index of displacement of fixed base relatives over twelve-month period, for years 1920-1926	84	+.95

The above coefficients give evidence of the same relationships as were found in studying the various measures of year-to-year change, the only difference being that the relations among the monthly measures appear to be closer.

Because of the intercorrelation between indexes of price level changes, dispersion, and displacement, it is desirable to compute coefficients measuring the net or partial correlation between these variables. Annual measures have been employed in the first calculations. The variables, with the symbols representing them, are the following:

x_1: Percentage change in price level, from year to year, as computed from weighted logarithms of link relatives. (This variable measures the degree of change, without regard to sign.)

x_2: Index of price dispersion, computed from weighted logarithms of link relatives.

x_3: Index of price displacement, measuring the shifting of fixed base relatives from year to year.

All measures are for the period 1893-1926. The simple and net coefficients are given below. Some of the zero order coefficients differ slightly from those in the preceding section, because the period covered is slightly shorter in the present case.

$r_{12} = +.63$	$r_{12.3} = +.52$
$r_{13} = +.42$	$r_{13.2} = +.04$
$r_{23} = +.63$	$r_{23.1} = +.51$

These figures show an appreciable degree of net correlation between changes in the price level (without regard to sign) and price dispersion, and approximately the same degree of correlation between the dispersion of prices and the displacement of prices. There appears to be no relationship between changes in the price level and the displacement of prices. The apparent relationship shown by the simple coefficient of correlation is due to the intercorrelation of the variables being studied. Changes in the price level do not tend to increase or decrease the degree of price shifting, except indirectly through the effect of such changes upon the degree of dispersion.

A measure of the multiple correlation between price level changes, on the one hand, and price dispersion and displacement on the other, possesses significance. For this we have:

$$R_{1.23} = .63$$

This coefficient measures the relationship between two types of price instability, instability of the price level and internal instability.[1] In combining x_2 and x_3, as we do in computing the coefficient of multiple correlation, we treat the factors of dispersion and displacement as a composite unit. This composite constitutes the best available measure of disturbances in the relations among commodity prices, disturbances due either to changes in relative position or to alterations in the established margins which separate individual commodity prices. For convenience we may represent by the symbol w the composite variable which measures internal disturbances, and by z the variable which measures changes in the level of wholesale prices. As a measure of correlation we have, then:

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[1] It appears, from the coefficients of net correlation, that the influence of changes in the price level upon degree of price displacement is felt only through the medium of dis-

$$r_{wz} = .63$$

This coefficient throws some light on the following question: Assuming that the relationship measured by this coefficient is a causal one,[2] to what extent would the violence of internal price disturbances be lessened if the price level could be stabilized? The coefficient of determination may be derived from r. In the present case we have:

$$d_{wz} = r^2_{wz} = .40$$

We may interpret this coefficient in the following fashion: If we assume a causal connection between a dependent and an independent variable, and if we measure variability in terms of the standard deviation squared, the coefficient of determination is a measure of the percentage of variability in the dependent variable which is attributable to the independent variable. The correlation of $+.63$ between w and z means, on the assumption of a causal connection between the two, that 40 per cent of the variability of w (the dependent variable) is attributable to z.[3]

In the present case this interpretation of the results throws some light on questions of considerable importance. Granting that w, the composite index of dispersion and displacement, truly reflects those internal disturbances which upset business and distort eco-

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persion. Yet I think it desirable to carry forward the discussion in terms of the multiple coefficient, though it is in this case identical with the simple coefficient which measures the relation between price level and dispersion changes. Internal changes in business relations result both from dispersion and displacement, and the two in combination constitute the most appropriate measure of business disturbance.

[2] Stated values of the coefficient of correlation do not, of course, warrant the assumption of a causal relationship between variable quantities. There is probably, in the present case, some justification for assuming a causal connection between external and internal instability, between changes in the price level, as cause, and disturbances of internal relations, as effect.

[3] The *remaining variability* of w is 60 per cent of the original variability, as measured in terms of the standard deviation squared. If there were a single other factor, y, which accounted in full for this remaining variability, the value of d_{wy} would be .60, and the value of r_{wy} would be $+.77$.

The coefficient of determination is discussed in the footnote on pp. 147-148.

nomic relations, the coefficient of +.63, measuring the relation between changes in the general level of prices and this index of internal disturbance, indicates that changes in the level of prices are responsible only in part for internal instability. Assuming that the relationship is causal, the internal disturbances would be reduced by about 40 per cent if the price level were stabilized. Approximately 60 per cent of the dispersion and displacement of prices must be attributed to the play of other forces.

This conclusion, of course, applies only to wholesale prices. The broader question of the effect of stabilization of the price level upon other price relations lies outside the present discussion. And within the field of wholesale prices it is presented with the qualifications and limitations suggested above.

The monthly measures of change in the price level, in price dispersion and in price displacement, covering the years 1920 to 1926, may be treated in a similar fashion. Following are the variables and the corresponding symbols:

x_1: Percentage change in price level over twelve-month interval, without sign.
x_2: Index of dispersion computed from twelve-month link relatives.
x_3: Index of displacement over twelve-month interval, computed from 1913 base relatives.

The simple and partial coefficients of correlation are:

$r_{12} = +.80$
$r_{13} = +.73$
$r_{23} = +.95$

$r_{12.3} = +.53$
$r_{13.2} = -.19$
$r_{23.1} = +.89$

These measures confirm the conclusions based upon the annual measures of price changes. There is a significant relationship, though not an extremely close relationship, between the degree of change in the price level (without sign) and the degree of dispersion. The net relation between these variables, on the monthly basis, is almost identical with that found in the study of annual measures ($r_{12.3} = +.53$ for the twelve-month links, +.52 for the annual links). Changes in the price level are not related to the shifting or displacement of prices except through the effect of price level changes upon dispersion. There is a close positive correlation between the degree of dispersion of twelve-month link relatives and the displacement, over the same twelve-month interval, of fixed base relatives. This latter relationship is materially higher than that found to prevail between the annual measures of dispersion and displacement ($r_{23.1} = +.89$, as compared with $+.51$ for the annual measures).

As in handling annual data, we may consider the coefficient of multiple correlation, $R_{1.23}$, to be equivalent to a simple coefficient, r_{wz}, where w represents a composite measure of internal disturbance, due both to the dispersion and the displacement of price relatives, and z represents changes in the general price level. We have

$$R_{1.23} = r_{wz} = .81$$

For the coefficient of determination we have

$$d_{wz} = r^2_{wz} = .66$$

We may interpret this in the following fashion: On the assumption of a causal connection between changes in the level of prices and internal disturbance of price relations, we may say that during the seven year period from 1920 to 1926, 66 per cent of the internal disturbance in price relations was due to changes in the price level. Thirty four per cent of the internal disturbance was due to other causes.

These last results differ somewhat from those secured in the study of annual data. The coefficient of determination which, on the assumptions made, measures the percentage of internal disturbance which may be attributed to price level changes, had a value of 40 per cent, when annual measures over the period 1893-1926 were employed. The higher value of the coefficient based on monthly values between 1920 and 1926 is, perhaps, attributable to the fact that the latter period includes a time of violent change in the price level. There is reason to believe that during such a period there is a closer relation between external changes and internal disturbance than there is during more stable times.

Both results lead to the same general conclusions: There is a significant relation between changes in the level of prices and internal disturbance in wholesale price relations. There is a tendency for the degree of internal disturbance to vary with changes in the price level, the internal disturbance being greater the greater the degree of change in the price level. It is the amount of change in the price level, not the direction of change, which is significant. If we may assume that the connection between these variables is a causal one, internal disturbance being influenced by external changes in the price level, the results indicate that the relationship is one of partial dependence only. The samples here studied indicate that from 34 to 60 per cent of the internal disturbance in price relationships is apparently due to other factors. There is some indication that the proportion of the internal disturbance which is attributable to price level changes tends to become greater during periods of violent change in the purchasing power of the dollar.[1]

VIII Summary

1. The investigation of the behavior of price relatives in combination has been approached as a study of price instability. Three types of instability have been distinguished and corresponding measures have been employed.

In measuring *instability of the price level* index numbers of the usual type have been used.

In measuring *internal instability*, arising from alterations in the relations among the prices of different commodities, use has been made of indexes of price dispersion and of price displacement. The dispersion of prices results from the varying movements of individual commodity prices between given dates. The index of dispersion of which chief use has been made in the present investigation has been derived from the standard deviation of logarithms of price relatives. The dispersion both of fixed base and link relatives has been measured. Price displacement, which reflects a second type of internal instability, results from the shifting of the relative positions of commodity prices. The index of price displacement is derived from the coefficient of rank correlation.

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[1] The above conclusions are to be interpreted in terms of the particular measures of internal disturbance which have been employed and with reference to the methods used in measuring the relations among the several variables. The price dispersion which has been measured is that of link relatives, while the index of displacement is derived from fixed base relatives. The conclusions are valid to the extent that these two measures reflect internal disturbances in the relations among different elements in the business system. It is quite possible that more satisfactory indexes of changes in price relations may be developed. In any case it is desirable that the conclusions be tested when broader data or better measures are available.

Although it seems desirable to put the conclusions in the definite form employed in the text, the impression of accuracy which such figures give is misleading. It is misleading partly because of the relative smallness of the sample; more important, I think, is the probability that the relations in question vary from period to period. It appears, from a study of the results in detail, that the degree of relationship between changes in the price level and changes in dispersion and displacement is far from constant, and that the differences between periods are even greater than those which the two sets of results given above would indicate. During periods of extreme disturbance those monetary and credit changes which are reflected in changing price levels are of dominant importance in determining the degree of internal instability. If the study were restricted to monthly data drawn from such a period (say the period from 1915 through 1921) one might expect an even closer relationship than that found for the period 1920 to 1926. During periods marked by only minor changes in the price level a very much lower degree of relationship between external and internal changes would be expected. At such times those specific price-making forces which affect the prices of individual commodities are vastly more important in causing shifts in internal relations than are the general factors which touch individual prices only through changes in the purchasing power of the monetary unit. For this reason, the coefficients of correlation and of determination derived from annual data for the period 1891-1926 are probably too low if relations between external and internal changes during periods of extreme price disturbance are in question, too high if interest attaches to the same relations during periods marked by minor changes in the level of prices.

The third type of price instability is a group attribute. In studying it we deal with the entire population of prices as an organic entity. The investigation of this type of instability deals with questions of homogeneity, and with the character of the forces which bring about particular types of distributions. In the description of groups the criteria of distribution types developed by Karl Pearson have been employed. Accepting the Gaussian (normal) distribution and distributions of Type III in Pearson's classification as stable types, the degree of departure of various price distributions from these types has been measured. Changes from year to year in the characteristics of frequency distributions of price relatives have been followed. Distributions of fixed base and link relatives, of unweighted and weighted relatives, and of relatives in natural and in logarithmic form have been contrasted in respect to their basic characteristics.

2. In connection with the measurement of changes in the level of wholesale prices a number of measures of the sampling reliability of different types of index numbers have been computed. Among the facts revealed by these measures of reliability are the following:

a. When about 200 commodity price series are used and when there is an approximately normal degree of dispersion of wholesale prices, the standard errors of unweighted arithmetic and geometric means of link relatives average slightly less than one per cent of their respective means.

b. The sampling errors of averages computed from fixed base relatives increase sharply during the first several years after the base year, but thereafter the change in the sampling error is slight. With about 200 commodity price series, and in the absence of extreme dispersion, the standard errors of unweighted arithmetic and geometric means of fixed base relatives amount to about 1.8 per cent of their respective means when the base of the relatives is ten years removed.

c. Except during periods of extreme price disturbance the sampling errors of arithmetic and geometric means are about equal. In periods of disturbance the arithmetic mean is subject to much greater sampling errors.

d. The use of weights adds to the sampling errors of index numbers. The standard errors of weighted averages, as estimated in the present study, are from one-half to two-thirds again as large as the standard errors of corresponding unweighted averages.

3. The dispersion of price relatives on a fixed base tends to increase as the base year becomes further removed, but under ordinary circumstances this increase is at a decreasing rate after the sharp initial increase during the several years immediately following the base year.

4. During the years from 1891 to 1913 the movement of the index of dispersion computed from link relatives was gradually downward. This tends to substantiate other evidence that during the several decades prior to the war the price system was becoming somewhat more stable.

5. The index of dispersion computed from link relatives registered higher values during the years 1916-1923 than in any previous year since 1890. The maximum degree of internal disturbance, as measured by this index, was experienced in the price movements between 1920 and 1921. By 1924 the index had declined to a level which approximated pre-war standards.

6. There has been found no tendency for the dispersion of price relatives to increase with rising prices and to decline with falling prices. There is, however, a relation between the degree of dispersion and the degree of change in the price level. The dispersion tends to increase the greater the disturbance of the price level, whether prices be rising or falling.

7. In measuring price displacement during the war and post-war years three different sets of price relations have been used as standards, or criteria.

a. The first of these is based upon the ranking in 1914 of relatives on the 1913 base. This ranking defines a set of price relations which is the result of economic changes during but a single year. This set of relations was almost completely destroyed as the result of developments between 1914 and 1916. By 1918 not a vestige of it remained. In 1925 and 1926 there was a slight swing back toward the relations defined by this criterion.

b. The second criterion of pre-war price relations is furnished by the ranking in 1914 of relatives on the 1891 base. This ranking reflects a firmly established set of price relations, since it represents the net effect of economic changes over a period of 23 years. As is to be expected, the index of displacement with reference to this criterion shows much less radical shifts during the war and post-war years. There were fundamental alterations in these relations, but in its main outlines this system survived the war. Maximum displacement was recorded in 1923. The three succeeding years brought a distinct swing back toward pre-war relations.

c. In securing a third criterion, which would represent a fairly well-founded set of pre-war price relations, but one which did not depend upon prices so far removed as those of 1891, relatives on the 1909 base were computed. The values of these relatives, for individual commodities, were averaged for the years 1911-1914, and the ranking of these averages furnished the desired standard. The set of relations thus defined was profoundly modified by the changes of the war period, but was not destroyed. The degree of change was greater than the change in the set of relations based upon 1891 relatives, and less than the change in the set of relations based upon 1913 relatives. It is noteworthy that there is a close correspondence between the year-to-year changes in the three indexes of displacement described above. All agree in showing some movement back toward pre-war price relations during the years from 1924 to 1926.

8. A study of the frequency distributions of price relatives, and of the changes from year to year in such distributions yields information concerning the forces affecting the general system of prices. A condition of stable equilibrium is attained, and stable distribution types appear, when the causal factors are independent of each other and when there are so many forces in operation that

no one force exerts a preponderant influence. This stability is generated by the balance of forces affecting the prices of individual commodities.

The general analysis leads to the following conclusions:

a. Distributions of price relatives are of an erratic and extremely unstable character. They do not conform to any one ideal frequency type, although Type IV of Pearson's classification predominates.
b. The conditions which give rise to the normal distribution are seldom realized in the distribution of price relatives. Of 190 distributions analyzed in detail only 18 could be classed as conforming to the normal type, even when generous allowance is made for errors of sampling.
c. There is some improvement in stability of distribution type and in the efficiency of the orthodox descriptive measures when logarithms of price relatives are used, in place of relatives in natural form, when weights are employed, and when link relatives rather than fixed base relatives are combined.

9. The year-to-year changes in the form of distributions of price relatives reflect disturbances in the equilibrium of the price system which are due to variations in business conditions.

a. Distributions of fixed base relatives pass through a series of swings away from and back to a symmetrical form. Sharp rises and declines in prices, such as those which occurred in 1893, 1895 and 1916 distort these distributions and carry them far from the Gaussian type. These deviations may be in the direction of positive or negative skewness. Swings away from symmetry during periods of disturbance are followed by clear movements back toward a stable, symmetrical type of distribution, which approaches in several instances the Gaussian type. A striking example of the re-attainment of group stability after a severe disturbance is found in the changes in the characteristics of distributions of fixed base relatives between 1916 and 1923.
b. Somewhat similar departures from and returns to a symmetrical type are observable in the year-to-year changes in the distributions of link relatives, but the conditions under which the stable types emerge are not the same as those

under which stability of fixed base relatives is attained. In general, departures from symmetry in the direction of positive skewness are found in the years during which business activity is steadily increasing, with few conflicting movements. Swings in the direction of negative skewness come in years of recession or of depression. Symmetrical distributions appear to be characteristic of years during which there are reversals of business and price trends.

10. An attempt has been made to measure the relationship between instability of the price level and internal instability, the latter being measured by the indexes of dispersion and displacement, in combination. There has been found a tendency for the degree of internal disturbance to vary with changes in the price level, the internal disturbance being greater the greater the change in the price level. (It is the degree of change in the price level, not the direction of change, which appears to be related to internal disturbances.) If we assume that the causal relationship runs from changes in the price level to variations in the degree of internal disturbance, the evidence of the present study indicates that, during the years 1893-1926, approximately 40 per cent of the internal instability of wholesale prices could be attributed to fluctuations in the wholesale price level. The remaining 60 per cent may, on this evidence, be attributed to other causes which would, presumably, continue to operate if there were no changes in the level of prices.

The proportion of internal instability attributable to changes in the level of wholesale prices was somewhat greater, as measured by monthly indexes, during the years 1920-1926. Again assuming a causal connection, there is evidence that during this period some 66 per cent of the internal disturbance of price relations was due to changes in the price level. There is a suggestion here that during a period of violent change in the price level there is a closer relation between external changes and internal disturbance than there is during more settled times.

CHAPTER IV

MEASURES OF PRICE BEHAVIOR IN COMBINATION

We have attempted in the preceding chapter to secure information about the price structure by studying the characteristics of price relatives in combination. Such relatives describe only one aspect of price behavior. All the other measures of price behavior which were dealt with in the first two chapters may be combined in similar fashion in determining the characteristics of the population of prices. Although the data available do not permit an extension of this type of investigation to all aspects of price behavior, certain of the measures we have may be studied in respect to group attributes.

I Group Characteristics of Measures of Price Variability and Trend

1. Measures of Monthly Variability of Wholesale Prices, in Combination

The measures of monthly price variability which were described in Chapter I may be combined by years, or the averages for individual commodities over a term of years may be combined. The distributions secured from the annual values are of a type which does not vary greatly from year to year, except during periods of rather violent price change. In the following table six representative annual distributions are given, together with a distribution secured by classifying averages for individual commodities for the entire period from 1890 to 1925, exclusive of the disturbed years between 1914 and 1921.[1] These distributions are presented graphically, in the form of column diagrams, in Figure 52.

The distributions which relate to the relatively quiet years prior to the war are peaked and J-shaped, sharply skewed in a positive direction. There is a heavy concentration of frequencies at the lower end of the scale, indicating a relatively low degree of monthly variability for the great bulk of commodities. The tails tapering far to the right reveal the presence of a small number of

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[1] The averages combined in this distribution are those given in Appendix Table VI for farm products and foods and in Appendix Table IV for all other commodities.

TABLE 119

FREQUENCY TABLES SHOWING DISTRIBUTIONS OF COMMODITY PRICE SERIES CLASSIFIED ACCORDING TO MONTHLY VARIABILITY

(1) Class limits Measure of variability	(2) 1890	(3) 1901	(4) 1914	(5) Frequencies 1916	(6) 1920	(7) 1925	(8) Averages 1890–1925 excluding 1914–1921
.00—1.99	83	76	94	16	19	80	51
2.00– 3.99	40	51	40	27	22	42	57
4.00– 5.99	24	30	23	37	29	35	36
6.00– 7.99	18	18	19	35	30	25	33
8.00– 9.99	14	9	12	43	27	5	16
10.00–11.99	4	5	8	10	14	6	5
12.00–13.99	5	7	6	17	11	8	4
14.00–15.99	4	2	2	7	14	1	0
16.00–17.99	2	2	1	6	10	1	0
18.00–19.99	2	0	5	4	7	0	1
20.00–21.99	2	2	1	3	5	0	0
22.00–23.99	2	1	1	1	8	1	1
24.00–25.99	1	1	1	3	6	2	0
26.00–27.99	0	0	1	2	1	0	1
28.00–29.99	0	0		0	3	1	1
30.00–31.99	1	1		1	2	0	
32.00–33.99	0			0	1	3	
34.00–35.99	1			0	0	1	
36.00–37.99	1			0	2		
38.00–39.99				1	1		
40.00–41.99				0	2		
42.00–43.99				0			
44.00–45.99				0			
46.00–47.99				1			
Totals	204	205	214	214	214	211	206

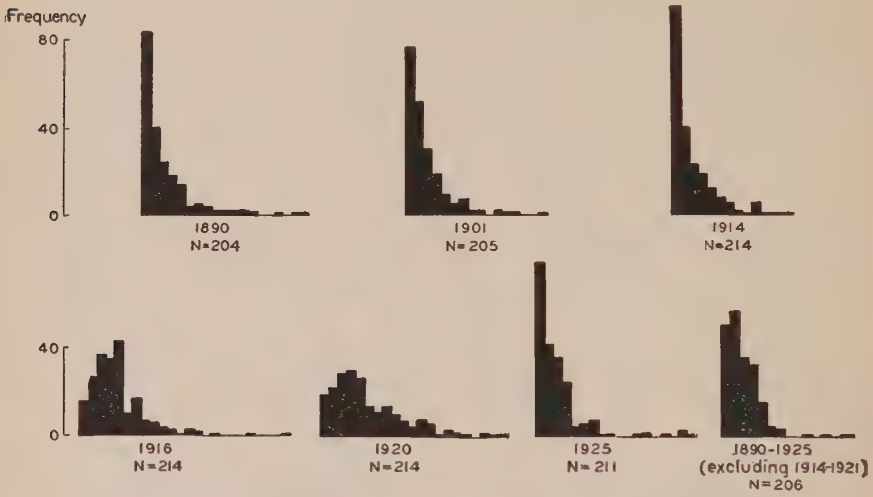
commodities marked by extremely high variability. This is characteristic, and is found in the distribution for each year of the period covered.

The distributions for the years 1916 to 1921 possess this tail extending to the right, but differ from the distributions of ordinary years in that the mode falls well above the lowest class. The distributions for 1916 and 1920 which are shown in Figure 52 furnish two somewhat different examples drawn from this period. They are positively skewed, but with the movement of the mode to the right there has come a closer approach to symmetry. The distribution for 1925 represents a return to the pre-war type.

These several distributions throw considerable light upon the nature of the population of commodity prices, when classified in respect to their variability from month to month. In normal times

FIGURE 52

Column Diagrams Showing Distributions of Measures of Monthly Variability for Selected Years, with a Distribution Based upon Averages for the Period 1890-1925.[1]



[1] The unit employed on the x-scale and the class frequencies are given in Table 119.

a stable group, fluctuating over a narrow range within the year, is of dominant importance. Proceeding up the scale of variability there is a decrease from the beginning in the frequencies found in successive classes. A few outlying commodities fluctuate widely within the year, but these constitute a very small minority of the total number.

This situation is not changed by the rather considerable advances and declines in the price level which occur during most business cycles. A great price revolution, however, increases the modal variability materially, and we secure distributions which approximate the type found in most collections of quantitative material. There is a decline in frequencies on both sides of the mode, but the relatively small group of widely fluctuating commodities remains, maintaining the pronounced positive skewness of the distributions.

The distribution of averages, for which the class frequencies are given in the last column of Table 119 and which is shown graphically in Figure 52, is sharply skewed in a positive direction, with a concentration of cases near the lower end of the scale. The mode is slightly above the lowest class, however, giving a distribution which in form tends slightly away from the type which was usual before the war.

Averages and measures of variation relating to the distributions of monthly variability measures for the years from 1890 to 1926 are summarized in the following table. Measures of the monthly

TABLE 120

MONTHLY VARIABILITY OF WHOLESALE PRICES

AVERAGES AND STANDARD DEVIATIONS COMPUTED FROM MEASURES OF PRICE VARIABILITY FOR INDIVIDUAL COMMODITIES, 1890-1926, WITH VARIABILITY MEASURES RELATING TO AN INDEX OF WHOLESALE PRICES.

(1) Year	(2) No. of price series	(3) Mean	(4) Standard deviation	(5) Monthly variability U. S. Bureau of Labor Statistics index
1890	204	4.8	6.2	
1891	204	4.4	5.9	
1892	204	4.5	6.0	
1893	206	4.9	5.8	
1894	206	4.6	4.6	
1895	206	6.3	6.7	
1896	206	4.7	4.7	
1897	206	4.8	5.7	
1898	206	4.1	4.7	
1899	206	6.0	5.6	
1900	206	5.5	5.9	1.34
1901	205	4.3	4.9	1.58
1902	214	4.7	6.3	2.58
1903	214	4.8	5.4	2.03
1904	214	4.1	4.3	1.26
1905	214	4.5	4.8	.77
1906	214	3.5	4.0	1.78
1907	214	4.5	4.8	1.42
1908	214	4.7	4.6	1.20
1909	214	4.6	5.3	2.66
1910	214	4.3	4.9	2.56
1911	214	4.3	5.6	1.79
1912	214	4.6	6.1	1.68
1913	213	3.7	5.1	.55
1914	214	4.4	5.3	1.23
1915	214	5.9	6.5	2.02
1916	214	8.7	6.5	6.89
1917	214	10.6	6.7	5.95
1918	213	7.3	5.5	3.37
1919	212	9.7	7.1	3.96
1920	214	10.8	8.8	6.95
1921	214	8.5	5.7	4.97
1922	213	6.5	6.6	3.86
1923	214	4.9	5.1	1.59
1924	213	5.4	5.5	1.61
1925	211	4.7	6.1	1.12
1926	211	4.2	4.9	1.23

variability of the general index of wholesale prices[1] for the years since 1900 are included for the purpose of comparison. The two sets of measures are shown in Figure 53.

The relative stability of the averages from year to year, prior to the war-time disturbances, is worthy of note. Only twice in the 25 years from 1890 to 1914 does the average rise above 6.0, and only twice does it fall below 4.0. In 20 of the 25 years it is between 4.0 and 5.0. We may judge from this considerable sample that except in times of such extreme price disturbances as were brought by the war, the amplitude of the fluctuations of individual prices, viewed collectively, does not vary greatly from one year to the next. The cyclical swings of the general price level are hardly apparent in these averages, which take account of all price changes. The host of accidental and seasonal price changes, the multitude of minor and major price movements which represent adjustments to shifting relations of supply and demand for individual commodities—all these go on without substantial break. Cyclical changes are, of course, intermingled with these at all times, but the point of importance is that there appear to be no pronounced increases or decreases in the degree of price variability which may be associated with cyclical swings of business or with cyclical swings in the general price level. Between January, 1909, and December, 1909, the price index rose from 93 to 103. The average measure of variability for that year was 4.58. In January, 1905, the price index had a value of 87; in December, 1905, the index had a value of 87. The index for the year fluctuated between 85 and 87. The average of the variability measures for 1905 was 4.55. The year 1909 was marked by considerable change in the price level while 1905 was a year of practically no change, yet the two averages, based upon the movements of individual commodity prices, were substantially the same in the two years.

This rather curious independence of the measures of changes in the general price level and the measures of fluctuations in individual commodity prices is clearly brought out when the annual averages given in column (3) of Table 120 are compared with measures of the monthly variability of the general price index, in column (5). They are graphically compared in Figure 53.

The absolute values of the averages relating to individual commodity prices are, of course, greater. Much of the variability of

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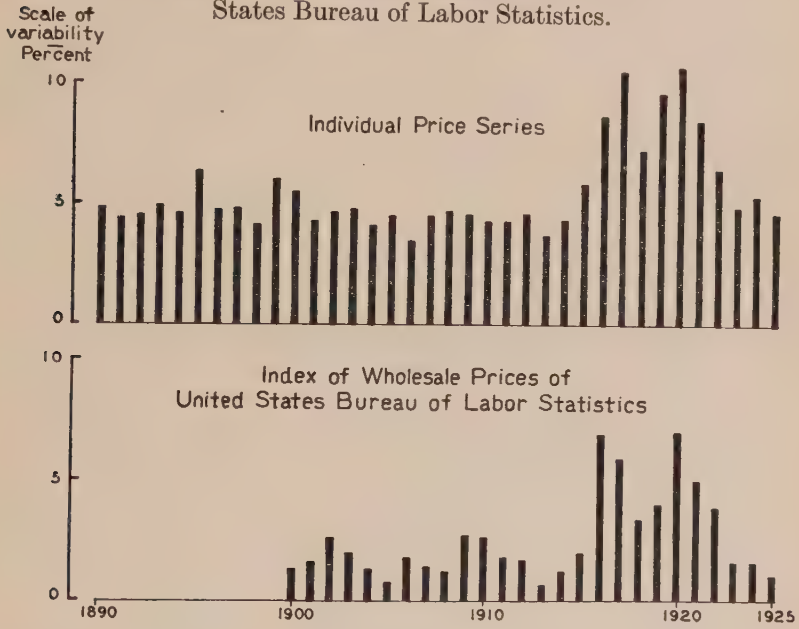
[1] The index of the United States Bureau of Labor Statistics. The measures of variability were secured by handling this index as an individual series, just as the prices of individual commodities were treated.

FIGURE 53

MEASURES OF MONTHLY VARIABILITY OF WHOLESALE PRICES.

Comparison of Annual Averages, Computed from Measures of Variability of Individual Price Series, with Measures Derived from the Index of Wholesale Prices of the United States Bureau of Labor Statistics.



individual prices is cancelled by opposite movements of other prices when an index is constructed. But the averages of the individual measures are much more stable from year to year than are the measures relating to the general index. Using annual values for the period 1900-1914, the coefficient of variation of the measures derived from the price index is 37.3; the corresponding coefficient for the averages is 10.1. During this period, at least, changes from year to year in the degree of variability of the index of wholesale prices were not paralleled by similar changes in the variability of individual prices.

The absence of a significant relationship between the averages of the individual measures of price variability and the measures of variation in the price index is clearly demonstrated by the coefficient of correlation. This coefficient has a value of +.19, when measures for the years from 1900 to 1914 are employed. (Corresponding items in columns (3) and (5) of Table 120 have been paired in computing this coefficient.)

The high values of the average measures of variability in 1895 and 1899 appear to be exceptions to the rule that the variability of individual commodity prices is not greatly affected by variations in the price level. The relatively high figure for 1895 is doubtless due to the sharp double reversal in the direction of the general price movement. A cyclical low value was recorded in March of that year, and a high in October. In 1899, the other year of high variability in the pre-war era, there was a considerable rise in the price level during the year.

It was pointed out in the preceding chapter, in discussing the trend of the index of dispersion, that there had been a distinct downward movement during the 24 years prior to the war. This was taken to be an indication of increasing price stability. The averages of the monthly variability measures show a similar tendency. The statistical evidence does not definitely prove the downward trend to be significant (the coefficient measuring the slope of a line fitted to the annual measures from 1890 to 1913 is equal to 1.45 times its standard error) but the tendency toward a decline in the degree of variability is worthy of note.

The two years in which the average measures of variability were lowest were 1906 and 1913, the former a year of unchecked prosperity, the latter a year of prosperity and recession. These exceptionally low values came in the decade preceding the war.

The previous discussion has dealt solely with the period prior to the war. The severe price disturbances of the years 1915 to 1922 increased the variability of individual commodity prices materially. In no one of the seven years from 1916 to 1922 does the average of the variability measures fall as low as the maximum value recorded prior to that time (6.3 in 1895). The tremendous price cycle of this period brought fluctuations in individual commodity prices which have no counterpart in our price history since 1890. Not until 1923 was the variability of individual prices reduced to a level approximating pre-war records. From 1920 to 1926 the annual averages of the variability measures moved steadily downward, except for a slight up-turn in 1924.

These annual averages of price variability indicate the average magnitude of fluctuations in individual commodity prices within a twelve-month interval. In so doing they throw light on a phase of price behavior which no other measure illuminates fully. The approximate stability of this average during years of rising and falling prices, during years of prosperity and depression, of revival and recession, is perhaps the fact of chief importance to be gleaned from this survey. Only an extreme price revolution changes materially the average amplitude of fluctuations in the prices of individual commodities.

The standard deviations which are given in column (4) of Table 120 are of interest in showing how extreme are the differences between individual commodities in the matter of monthly variability. In all but three of the pre-war years the standard deviations of these measures exceed their means. This wide range in the matter of variability was revealed by the individual figures given in Chapter I. The present set of measures describe this variation in quantitative terms.[1]

2. MEASURES OF YEAR-TO-YEAR VARIABILITY OF WHOLESALE PRICES, IN COMBINATION

When the measures of year-to-year variability for 216 commodities are combined, the following distribution is secured. This is shown graphically in Figure 54.

TABLE 121

FREQUENCY TABLE SHOWING THE DISTRIBUTION OF 216 COMMODITY PRICE SERIES CLASSIFIED ACCORDING TO YEAR-TO-YEAR VARIABILITY DURING THE PERIOD 1890-1913, WITH STATISTICAL MEASURES DESCRIPTIVE OF THE DISTRIBUTION

Measure of variability (1) Class limits	Measure of variability (2) Midpoint	(3) Frequency
.00– 1.99	1	7
2.00– 3.99	3	29
4.00– 5.99	5	34
6.00– 7.99	7	44
8.00– 9.99	9	23
10.00–11.99	11	24
12.00–13.99	13	21
14.00–15.99	15	17
16.00–17.99	17	11
18.00–19.99	19	2
20.00–21.99	21	1
22.00–23.99	23	1
24.00–25.99	25	1
26.00–27.99	27	0
28.00–29.99	29	0
30.00–31.99	31	0
32.00–33.99	33	0
34.00–35.99	35	1
Total		216
Mean	8.80	
Median	7.73	
Standard deviation	4.98	
Coefficient of variation	56.6	

---

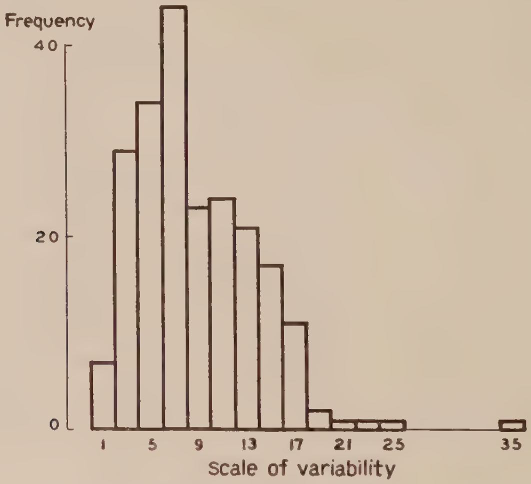
[1] The fact was noted at an earlier point that for J-curves, of the type to which the present distributions belong, the efficiency of the first and second moments is low. The

The distribution is peaked, and skewed in a positive direction. As with the measures of monthly variability there is a clustering of the great mass of the measures near the lower end of the scale, with a limited number of commodities which are highly variable in price lying far out to the right. The skewness is much less pronounced, however, than it is in the distribution of monthly measures. The dispersion of the individual measures about the mean is relatively high (coefficient of variation 56.6), but it is not so great as the dispersion of monthly variability measures. Differences between commodities in respect to monthly variability are greater than in respect to year-to-year variability.

FIGURE 54

Column Diagram Showing the Distribution of Measures of Year-to-Year Variability

Based upon Prices of 216 Commodities during the Period 1890-1913.



The remaining attributes of the distribution are discussed below, in comparing distributions relating to various measures of price behavior.

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means and standard deviations used in describing these distributions have not, therefore, the degree of validity they have in connection with distributions which come closer to the normal type.

3. MEASURES OF FREQUENCY OF PRICE CHANGE, IN COMBINATION

The frequency distributions of measures describing the behavior of commodity prices, which have been presented in Chapter III and in the preceding pages of this chapter, cover a wide variety of types, ranging from normal distributions to the most extreme divergent forms. When frequency of change measures are combined something entirely different in the way of frequency distributions is secured. These give a series of U-shaped distributions, a type which is relatively rare in the annals of statistics.

The measure of frequency of change for an individual commodity is secured by dividing the number of months in which a change in price is recorded by the total number of months for which prices are quoted, less one. This gives a quantity which varies between zero and unity, zero indicating no price change during the period covered, unity indicating a change in price every month. Such a measure has been worked out for each commodity for each of five different periods. Combining the measures for the separate periods, and for the entire period excluding the years 1914-1921, six frequency distributions are secured. The class frequencies are given in the following table.

TABLE 122

FREQUENCY TABLES SHOWING DISTRIBUTIONS OF 206 COMMODITIES CLASSIFIED ACCORDING TO FREQUENCY OF MONTHLY PRICE CHANGES

(1) Class limits Measure of frequency of change[1]	(2)	(3)	(4)	(5)	(6)	(7)
	Frequencies					
	1890–1897	1898–1905	1906–1913	1914–1921	1922–1925	1890–1925 (excl. 1914–1921)
.00– .10	58	49	58	7	35	45
.11– .20	18	22	19	25	31	25
.21– .30	20	20	23	25	14	16
.31– .40	14	13	14	23	14	19
.41– .50	6	12	9	25	8	14
.51– .60	5	12	8	11	5	7
.61– .70	11	11	8	17	10	6
.71– .80	12	8	13	13	7	15
.81– .90	10	13	13	12	18	15
.91–1.00	52	46	41	48	64	44
Totals	206	206	206	206	206	206

---

[1] The range of the first class in the above table (in actual values .00 to .105, the original measures being recorded to the second decimal place) is slightly greater than the range of any other class, and the range of the last class (in actual values .905 to 1.000) is slightly less than the range of any other class. The error introduced is negligible, however.

Column diagrams representing these distributions are plotted in Figure 55. Measures descriptive of the distributions are given below.

TABLE 123

FREQUENCY OF MONTHLY PRICE CHANGES

AVERAGES AND MEASURES OF VARIATION, BY PERIODS

(1) Period	(2) Mean	(3) Standard deviation	(4) Coefficient of variation
1890–1897	.456	.369	80.8
1898–1905	.467	.352	75.4
1906–1913	.441	.355	80.5
1914–1921	.540	.301	55.7
1922–1925	.534	.367	68.7
1890–1925 (excluding 1914–21)	.463	.350	75.6

The averages show a slight decline in the mean value of the measure of frequency of change during the three periods prior to the war, with approximately the same degree of variation throughout.[1] The three frequency distributions for these periods are of the same general U-shape. There is a rather significant elongation of the left arm of the U in the third period, however, and a corresponding shortening of the right arm. This means that there were, during the period from 1906 to 1913, relatively more commodities in the class for which the frequency of change was very small, and a smaller number of commodities in the class having an extremely high frequency of change, than there were during the two earlier periods. The tendency toward greater price stability which was in evidence during the several decades prior to the war is here apparent.

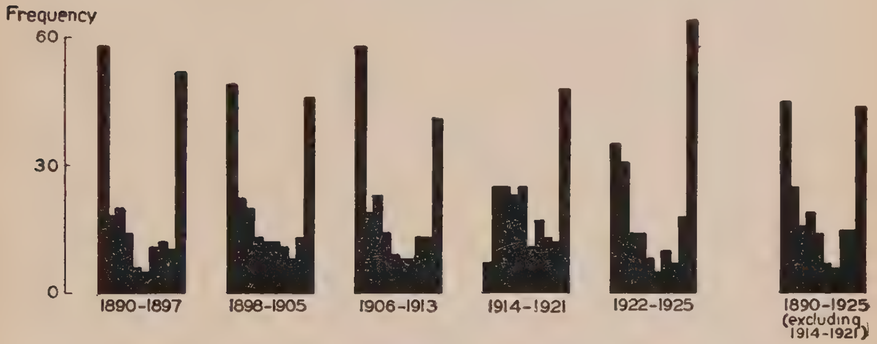
The war reversed this tendency. The long left arm of the distribution disappears, and the right arm is extended. Although there is a substantial concentration in the four classes next above the lowest, the modal class is that at the upper end of the scale. The average is materially higher than the averages computed from distributions for the three earlier periods.

The last period covered (1922-1925) witnessed a partial return

[1] Arithmetic mean and standard deviation lose much of their significance and validity when used in locating and scaling distributions of the U-type to which these belong. See R. A. Fisher, "On the Mathematical Foundations of Theoretical Statistics" *Phil. Trans. Royal Society of London*, Vol. 222A.

FIGURE 55

Column Diagrams Showing Distributions of Measures of Frequency of Price Change, by Periods.[1]



[1] The class intervals in which the x-scales are graduated are given in Table 122.

to the clearly defined U-type which prevailed before the war. The left arm, which represents the grouping of commodities which are quite stable in price, is again in evidence, although it is not so pronounced as in the first three distributions. The right arm is even more elongated than during the disturbances of the war period. The average remains high, but slightly below that for the period 1914-1921.

The final distribution, composed of measures of frequency of price change relating to the entire period from 1890 to 1925 (excluding the years 1914-1921), is fairly symmetrical, and of the U-type exemplified in the pre-war distributions.

4. Measures of Price Trends, in Combination

In Chapter I there were given measures defining the average annual rates of change in price, between 1896 and 1913, for 223 commodities. Differences between these rates, it was suggested, represent rather fundamental changes in economic relations, and are of considerable importance in a study of economic tendencies. The frequency distribution of these rates, and accompanying measures, are given in the following table. This distribution is shown graphically in Figure 56.

TABLE 124

FREQUENCY TABLE SHOWING THE DISTRIBUTION OF 223 COMMODITIES CLASSIFIED ACCORDING TO AVERAGE ANNUAL RATE OF CHANGE IN PRICE BETWEEN 1896 AND 1913, WITH STATISTICAL MEASURES DESCRIPTIVE OF THE DISTRIBUTION

(1) Class limits Rate of change (per cent)	(2) Midpoint	(3) Frequency
—3.50 to — 2.51	— 3	4
—2.50 to — 1.51	— 2	3
—1.50 to — .51	— 1	8
— .50 to + .49	0	31
+ .50 to + 1.49	+ 1	41
+1.50 to + 2.49	+ 2	58
+2.50 to + 3.49	+ 3	39
+3.50 to + 4.49	+ 4	20
+4.50 to + 5.49	+ 5	15
+5.50 to + 6.49	+ 6	2
+6.50 to + 7.49	+ 7	1
+7.50 to + 8.49	+ 8	0
+8.50 to + 9.49	+ 9	0
+9.50 to +10.49	+10	1
Total		223
Mean	+1.94	
Median	+1.93	
Standard deviation	1.83	

The general drift of prices was, of course, upward during this period. The arithmetic mean of the 223 measures is +1.94, representing an average increase in price of 1.94 per cent each year.[1] The standard deviation is 1.83, a figure which indicates rather considerable differences between the rates of increase of the constituent series. These differences have been commented upon at an earlier point.

The distribution is very nearly symmetrical, but departs from the normal type in the matter of peakedness. There is a heavier concentration of observations near the mean and a somewhat greater spread at the two extremities than in the normal distribution.

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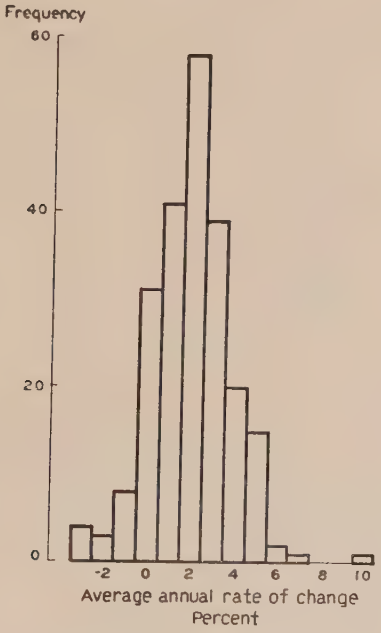
[1] This differs somewhat from the average annual rate of increase in the all-commodities index of the U. S. Bureau of Labor Statistics during this period, which was 2.35 per cent. The difference is due to three factors—the difference in the number of commodities included, the absence of weighting in securing the average of 1.94 per cent, and purely mathematical differences between the slope of a line fitted to averages of a number of series, and the average of a number of quantities measuring the slopes of lines fitted to individual series.

FIGURE 56

COLUMN DIAGRAM SHOWING THE DISTRIBUTION OF MEASURES DEFINING THE AVERAGE ANNUAL RATES OF CHANGE IN THE PRICES OF 223 COMMODITIES, DURING THE PERIOD 1896-1913.



§ Comparison of Distribution Types

In summary, we may compare the various measures which have been dealt with in the preceding sections of this chapter, the comparison being restricted to their group characteristics. The statistical measures descriptive of the different frequency distributions discussed above are summarized in the following table. Points defined by the criteria of curve type, β_1 and β_2, for the several distributions are plotted in Figure 57.

In studying these measures and in interpreting Figure 57 reference should be made to the several tables and figures in Chapter III describing the characteristics of distributions of price relatives, and to the accompanying explanations. The various distributions to which the measures in this and earlier chapters relate all represent different aspects of price behavior, and comparison of the results is significant for this reason.

The distributions of monthly variability measures are all of the J-type, with tails extending in the direction of positive values. Since the

TABLE 125

Statistical Constants Relating to Distributions of Measures of Price Variability and Trend

(1) Date or period	(2) Mean	(3) Median	(4) Standard deviation	(5) Coefficient of variation	(6) β_1	(7) β_2	(8) Skewness	(9) Kurtosis	(10) κ_1	(11) κ_2	(12) r	(13) Pearsonian curve type
Measures of Monthly Variability[1]												
1890	5.06	2.95	6.06	119.7	6.5007	10.9129		7.9129	—3.6763	—3.5434	—5.5690	I_J
1901	4.47	3.04	4.74	106.0	5.7748	10.3870		7.3870	—2.5504	—4.1879	—8.4980	I_J
1914	4.55	2.65	5.00	109.8	3.8725	7.0949		4.0949	—3.4277	—1.7171	—3.8902	I_J
1916	8.69	7.54	6.46	74.3	4.7557	10.6737		7.6737	1.0803	7.2384	27.3146	VI_J
1920	10.91	8.52	8.45	77.4	1.6603	4.5365		1.5365	—1.9079	—.9386	—5.9003	I_J
1925	4.94	3.26	5.97	120.9	8.7303	13.1357		10.1357	—5.9195	—3.6429	—3.4517	I_J
1890–1925 excluding 1914–1921	4.79	3.85	4.08	85.1	6.3436	13.1986		10.1986	1.3664	9.0199	25.7099	VI_J
Measures of Year-to-Year Variability												
1890–1913	8.80	7.73	4.98	56.6	1.2618	5.7513	.4034	2.7513	1.7172	.7320	12.1925	IV
Measures of Frequency of Price Change												
1890–1897	.456	.355	.369	80.8	.0474	1.3585	.1904	—1.6415	—3.4252	—.0124	—.5450	I_U
1914–1921	.540	.497	.301	55.7	.0058	1.5899	.1609	—1.4101	—2.8376	—.0017	—1.2350	I_U
1890–1925 excluding 1914–1921	.463	.395	.350	75.6	.0422	1.4393	.2217	—1.5607	—3.2480	—.0114	—.7334	I_U
Measures of Price Trend												
1896–1913	1.94	1.93	1.83	[2]	.0511	4.4405	.0652	1.4405	2.7277	.0147	7.4551	IV

---

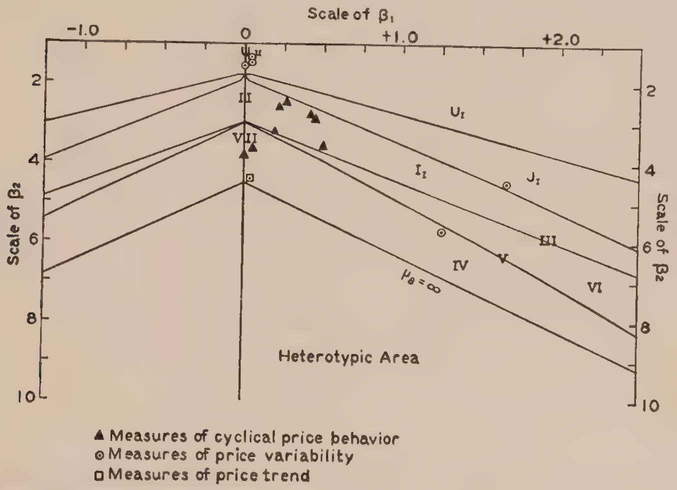
[1] The means and standard deviations of the first six distributions in this group differ slightly from those given in Table 120. The differences are due to the employment of a different class-interval and different class limits in the two cases Since all the distributions in this group are of the J-type, measures of skewness have been omitted.

[2] Because of the form in which the average annual rates of change have been expressed, the coefficient of variation would not be a significant measure for this distribution.

FIGURE 57

THE POPULATION OF PRICES.

Diagram Showing the Location of Points Defined by the Values of β_1 and β_2 for Distributions of Measures Describing the Behavior of Commodity Prices.[1]



corresponding ideal curves are modeless (being asymptotic to the vertical axis) no measure of skewness which is comparable to the measures relating to modal distributions can be secured.

The measures of year-to-year variability give a positively skewed Type IV distribution. The coefficient of variation is distinctly smaller than it is for the distributions of measures of monthly variability.

Points representing the three distributions relating to frequency of price change fall in a cluster not far from the axis of symmetry, at a point on the scale of β_2 values lower than has been reached by any of the measures for other distributions. These are the U-shaped distributions which have been commented upon above. (For these distributions the measure of skewness is the ratio to the standard deviation of the distance from mean to anti-mode.)

The distribution composed of measures of the average annual rates of change in the prices of individual commodities between 1896 and 1913 is a peaked, Type IV distribution, which is almost symmetrical.

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[1] The points representing distributions of measures of monthly variability for the following years fall beyond the limits of the chart:

	β_1	β_2
1890	6.5007	10.9129
1901	5.7748	10.3870
1914	3.8725	7.0949
1916	4.7557	10.6737
1925	8.7303	13.1357
1890-1925, excluding 1914-1921.	6.3436	13.1986

One point calling for comment is the fact that none of these distributions falls in the heterotypic area. This is in sharp contrast to the situation portrayed by Figures 43 and 48, relating to distributions of price relatives. Of 190 distributions of price relatives which were analyzed in detail, 90 (47 per cent of the total) were heterotypic. There is reason to think that heterotypic distributions contain certain elements of instability, that the populations to which such distributions relate do not cohere as closely or are not as homogeneous as are populations from which distributions of more orthodox types are drawn. Judging from this evidence one would conclude that prices are least stable, are most exposed to the influence of unbalanced and disruptive forces, in respect to the degree of change between specific dates. Distributions which are much more stable, when tested in terms of their positive moments, are secured when the population of prices is sampled in regard to general variability, or in respect to the rates at which prices change over a period of years.[1]

II Group Characteristics of Measures of Cyclical Price Movements

A number of measures dealing with the behavior of commodity prices during cycles in general business have been described in the first chapter. These measures may be combined in various ways in a study of the price aspects of the business cycle. The timing, the duration and the magnitude of price changes during these cyclical swings may be studied, the emphasis being upon general tendencies and averages, rather than upon the behavior of individual price series. Each cycle may be studied as a unit and compared with other cycles in this analysis, or the average behavior of commodity prices, in combination, in all cycles, may be investigated. The detailed discussion of individual cycles may be preceded by a general survey of the price movements which have occurred during the cycles covered in the present study.

---

[1] It is important to note, however, that these latter distributions, which are stable when judged with reference to the probable errors of the descriptive statistics, contain many representatives of the families of U-curves and J-curves. (All the distributions of measures of frequency of price change are of the U-type, and all the distributions of measures of monthly price variability are of the J-type.) Most distributions of this type, it has been contended by R. A. Fisher, lie outside the area within which the method of moments may be efficiently applied in deriving from a sample information concerning a general population. In particular, it is questionable whether the first and second moments (as used in deriving means and standard deviations) furnish valid bases for generalization. Accordingly, although our constants may not be characterized by infinite probable errors when we sample the population of prices in respect to the attributes at present under discussion, other difficulties are encountered when we apply familiar methods to these samples. The outline of an alternative method appears in the memoir by R. A. Fisher which has been previously cited. ("On the Mathematical Foundations of Theoretical Statistics," *Phil. Trans. of the Royal Society*, Vol. 222A)

1. THE EXTENT OF COMMODITY PRICE CHANGES DURING BUSINESS CYCLES

It is a matter of interest to determine the extent to which individual commodity price series are affected by the cyclical swings of general business. The following summary shows how the 209 price series included in the study of cyclical movements have behaved during each of the ten cycles which occurred in the United States between the revival of 1892 and the revival of 1924. In classifying the behavior of a given commodity during a specific cycle, account has been taken of the entries relating to a period of revival and to the succeeding period of recession. Thus if specific dates are recorded for an up-turn during revival and for a down-turn during the succeeding recession, a commodity is classed as having passed through a complete cycle. The periods are listed in section IV of Chapter I. The data relating to separate cycles are plotted in Figure 58.

TABLE 126

PERCENTAGE CLASSIFICATIONS OF 209 COMMODITY PRICE SERIES, SHOWING THEIR BEHAVIOR DURING EACH OF TEN BUSINESS CYCLES

(1) Terminal dates of cycle	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Percentage of total number of commodities						
	Passing through complete cycle	Constant during cycle	Rising during cycle	Sagging during cycle	Sharing in revival but not in following recession	Sharing in recession but not in preceding revival	All other[1]
Low of 1892 to low of 1895	66.5	7.2		16.3	.5	7.6	1.9
Low of 1895 to low of 1897	69.4	11.0		13.9	1.4	3.8	.5
Low of 1897 to low of 1901	78.0	3.8			17.7	.5	
Low of 1901 to low of 1904	65.1	6.7	.5	1.4	12.9	11.0	2.4
Low of 1904 to low of 1908	71.3	6.7		1.4	8.1	11.5	1.0
Low of 1908 to low of 1911	70.3	11.5		2.4	8.6	5.8	1.4
Low of 1911 to low of 1914	67.0	12.4		2.9	12.0	3.8	1.9
Low of 1914 to low of 1919	75.6		2.9		19.1	2.4	
Low of 1919 to low of 1922	76.1		1.4	.5	1.9	19.1	1.0
Low of 1922 to low of 1924	71.3	4.8		4.8	16.2	.5	2.4
Percentages based on totals for 10 cycles	71.1	6.4	.5	4.3	9.9	6.6	1.2

---

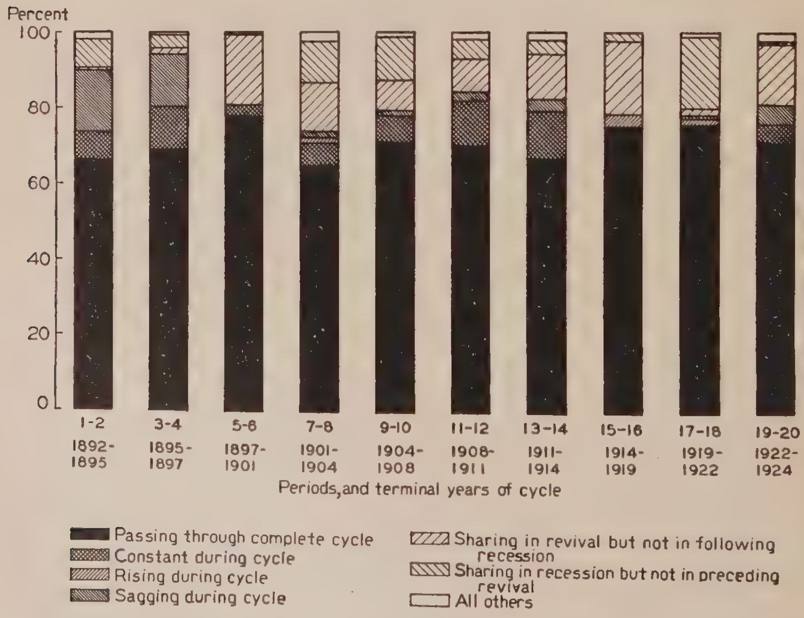
[1] This category includes those not sharing in revival or recession but with mixed behavior during these phases, as sagging during revival and constant during recession.

In interpreting these figures the qualifications concerning the procedure which were mentioned in the first chapter should be borne in mind. Perhaps the most important of these, from our present view point, is that no attempt has been made to isolate cyclical movements from secular, seasonal and accidental changes. It is certain, therefore, that changes of the latter types are to some extent reflected in the summary given above. Moreover, movements in the prices of certain agricultural products which are affected by conditions not immediately related to business changes are included in the price fluctuations here tabulated. Yet all these changes, attributable to whatever factors, are of concern to business men, and there is justification for taking account of them in a description of price movements during business cycles.

FIGURE 58

THE BEHAVIOR OF COMMODITY PRICES DURING BUSINESS CYCLES.

Percentage Distributions of 209 Commodities Classified according to Behavior during Ten Business Cycles.



The proportion of commodities recorded as passing through the complete cycle varies from 65.1 per cent of the total, in the cycle from 1901 to 1904, to 78.0 per cent of the total, during the cycle which began with the general price recovery of 1897 and culminated in the recession of 1900. The percentages for the cycles of 1914 to 1919, and of 1919 to 1922, are very close to this latter figure. The average for all ten cycles (computed from the absolute total, not from the percentages) is 71.1 per cent.

These figures are significant in several respects. It is a noteworthy fact that during every cycle some 70 per cent of all commodities experience price changes which have some connection in time with the cyclical turns in general business activity. The rough equality of the percentages for the separate cycles may be remarked.[1] This equality is doubtless due in part to the presence in any group of wholesale price series of a considerable number of highly variable series, which would be listed as passing through every cycle. The existence of such a body of variable price series is, of course, a fact of some importance. Material additions to this group, such as are found in the entries for the cycles beginning in 1897, in 1914 and in 1919, reflect deep disturbances, since they are due to fluctuations in the more stable price series which are not normally affected by the cycles in general business. The magnitude of these disturbances is greater than is indicated by the increases in the percentages listed in the table.

The proportion of commodities remaining constant in price throughout a complete cycle has averaged 6.4 per cent. In two cycles, those which ran their courses between 1914 and 1922, there were no commodities which were constant. The average proportion rising throughout given cycles has been .5 per cent, while the average proportion sagging has been 4.3 per cent. This latter figure has risen as high as 16.3 per cent, in the cycle between 1892 and 1895.

In the cycle which began in 1892 only .5 per cent of the commodities shared in revival but not in recession. This percentage reached 19.1 in the cycle beginning in 1914. The average percentage in this category, for all cycles, was 9.9. The proportion sharing in recession but not in revival varied between precisely the same limits, but the average has been only 6.6 per cent.

The entries on any one line of the above table provide a complete account, in summary, of the behavior of prices during a given cycle. A cycle-by-cycle study of these figures throws light on certain interesting differences between cycles. Further comment here is unnecessary.

---

[1] This equality would be broken if the short recession of 1919 and the ensuing revival were to be ignored. Approximately 95 per cent of the total number of commodities would then be listed as having passed through a cycle extending from a low in 1914 to a low in 1922.

Somewhat more detailed information concerning price behavior during the cycle may be derived from a separate study of the phases of revival and recession. In Table 127 are shown the number of commodities for which a specific low date was recorded for each of the 11 periods of revival studied, the number classed as *constant* in price, the number *rising* and the number *sagging* in price during each of these periods. The number in each category is also expressed as a percentage of the total. The percentage distributions of commodities among the classes designated above are shown graphically in Figure 59

The proportion of commodities sharing in revival fluctuates somewhat from cycle to cycle, averaging approximately 80 per cent of the total. The smallest percentage is 67.0, recorded for the revival in period 1 (reference date May, 1892), and the next smallest is 67.4 for the revival in period 21 (reference date June, 1924). [If we include among those sharing in revival the commodities which were rising (i. e., continuing a rise which had begun prior to the revival in question) the figure for period 21 is raised somewhat. To get a true measure of the pervasiveness of a given revival the commodities classed as rising should probably be combined with those for which a definite low date has been recorded.] The revivals which were most widely reflected among commodity prices were those of period 5 and period 15, in each of which approximately 95 per cent of all commodities are recorded as sharing in revival. The former period, centering at May, 1897, marked the beginning of a sustained price advance which continued at a fairly regular rate until the price disturbances of the war years developed. The latter, centering at November, 1914, is the revival which culminated in the sharp advances of the war period. To the figure for period 15 might be added 4.8 per cent, representing commodities which were rising throughout this period, giving a total of 99.5 percent as the proportion which actually moved upward in price at this time.

There are considerable variations from period to period in the proportion of commodities falling in the other main classes. The group of commodities listed as sagging is relatively large in periods 1 and 3 (18.7 and 13.9 per cent of the total), and then becomes negligible until the last two periods. The group classed as rising first becomes appreciable in period 7, centering at July, 1901, but

TABLE 127

Classifications of 209 Commodity Price Series, Showing their Behavior during Each of Eleven Periods of Revival[1]

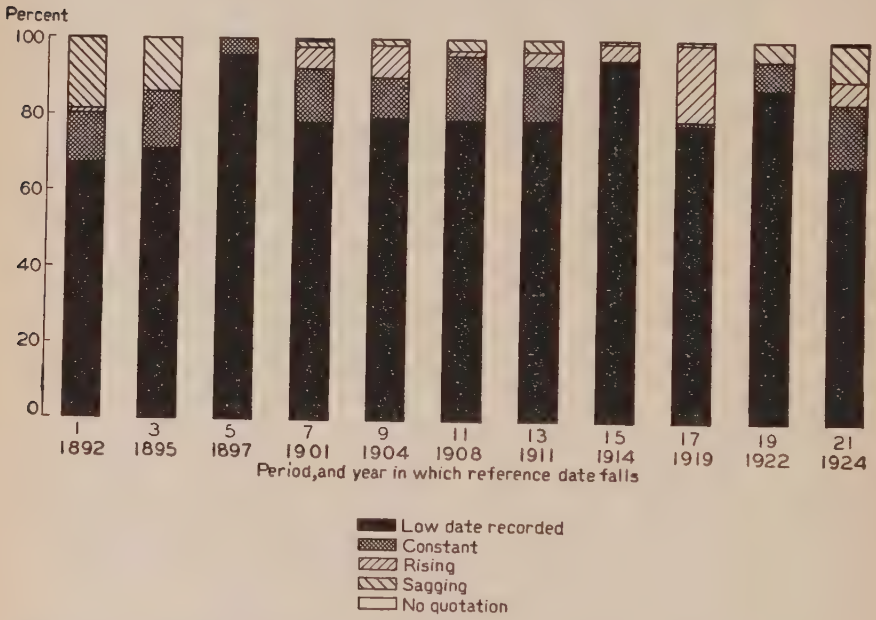
Nature of entry	Period 1		Period 3		Period 5		Period 7		Period 9		Period 11		Period 13		Period 15		Period 17		Period 19		Period 21	
	No.	Per-cent	No.	Per-cent	No.	Per-cent	No.	Per-cent	No.	Per-cent	No.	Per-cent	No.	Per-cent	No.	Per-cent	No.	Per-cent	No.	Per-cent	No.	Per-cent
Low date recorded	140	67.0	148	70.8	200	95.7	163	78.0	166	79.4	165	78.9	165	78.9	198	94.7	163	78.0	183	87.5	141	67.4
Constant	28	13.4	32	15.3	9	4.3	30	14.4	22	10.6	35	16.8	30	14.4	0	0	2	.9	15	7.2	34	16.3
Rising	2	.9	0	0	0	0	12	5.7	18	8.6	3	1.4	8	3.8	10	4.8	43	20.6	0	0	13	6.2
Sagging	39	18.7	29	13.9	0	0	3	1.4	3	1.4	6	2.9	6	2.9	1	.5	1	.5	11	5.3	20	9.6
No quotation							1	.5													1	.5
Totals	209	100.0	209	100.0	209	100.0	209	100.0	209	100.0	209	100.0	209	100.0	209	100.0	209	100.0	209	100.0	209	100.0

[1] For a definition of the periods here listed see p. 81.

FIGURE 59

THE BEHAVIOR OF COMMODITY PRICES DURING REVIVAL.

Percentage Distributions of 209 Commodities Classified according to Behavior during Eleven Periods of Revival.



does not constitute a significant proportion of the total until period 17, centering at February, 1919. About 20 per cent of the total number of commodities rose in price throughout the recession of period 16 and the revival of period 17. The group which is constant in price during revival varies from 4 to 17 per cent of the total, except in two periods. It disappeared altogether in period 15, and amounted to but 1 per cent of the total in period 17.

Table 128 contains information relating to price behavior during business recessions, arranged in a form comparable to that of the preceding table. The percentage distributions of the commodities tabulated are shown graphically in Figure 60.

The percentage of commodities passing through definite recessions varies from cycle to cycle, being between 70 and 80 per cent of the total during most of the periods covered. It exceeds 80 per cent only in period 10 (which centers at October, 1907) and in period 18 (centering at May, 1920). In the second of these periods

TABLE 128

Classifications of 209 Commodity Price Series, Showing their Behavior during Each of Ten Periods of Recession[1]

Nature of entry	Period 2		Period 4		Period 6		Period 8		Period 10		Period 12		Period 14		Period 16		Period 18		Period 20	
	No.	Per-cent	No.	Per-cent	No.	Per-cent	No.	Per-cent	No.	Per-cent	No.	Per-cent	No.	Per-cent	No.	Per-cent	No.	Per-cent	No.	Per-cent
High date recorded	155	74.1	153	73.2	164	78.4	159	76.1	173	82.8	159	76.1	148	70.8	163	78.0	199	95.2	150	71.8
Constant	20	9.6	25	12.0	29	13.9	25	12.0	30	14.4	36	17.2	43	20.6	1	.5	1	.5	31	14.8
Rising	0	0	1	.5	15	7.2	22	10.5	3	1.4	8	3.8	10	4.8	43	20.6	5	2.4	18	8.6
Sagging	34	16.3	30	14.3	0	0	3	1.4	3	1.4	6	2.9	8	3.8	0	0	1	.5	10	4.8
No quotation					1	.5									2	.9	3	1.4		
Totals	209	100.0	209	100.0	209	100.0	209	100.0	209	100.0	209	100.0	209	100.0	209	100.0	209	100.0	209	100.0

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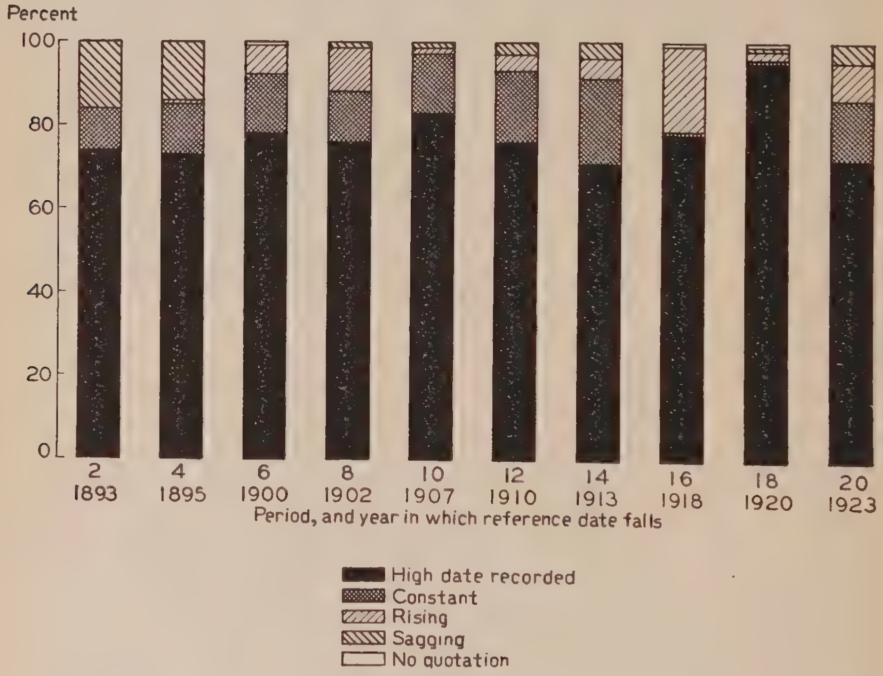
[1] For a definition of the periods here listed see p. 81.

it reaches 95.2 per cent. The recession of 1920 was, of course, the most pervasive of those through which American business has passed within the period here covered.

FIGURE 60

THE BEHAVIOR OF COMMODITY PRICES DURING RECESSION.

Percentage Distributions of 209 Commodities Classified according to Behavior during Ten Periods of Recession.



Sagging prices constituted a noticeable proportion of these entries during the first two periods only, when they amounted to 16.3 per cent and 14.3 per cent of the total. Commodities marked by constant prices during recession have made up from 10 per cent to 20 per cent of the total, except during periods 16 and 18 (centering at September, 1918, and May, 1920), when they amounted to but one half of 1 per cent of the total. Commodities which rose in price during recession constituted over 20 per cent of the total in period 16 (centering at September, 1918). At other periods the number in this group has never exceeded 10.5 per cent of the total.

The story of price behavior during recession which these figures tell differs in details from that relating to revival, but the general account is much the same. Prices of the large bulk of commodities are affected to some extent during general business revivals and recessions. There remains, except during the most widespread movements, a considerable group of commodities which are unchanged in price during these cyclical swings, or which continue upward or downward movements which were under way prior to the coming of specific cyclical phases.

2. COMPARISON OF PRICE CYCLES, 1890-1925, IN RESPECT TO THEIR MAJOR CHARACTERISTICS

a. *The Timing of Revival and Recession in Commodity Prices.* A comprehensive view of the upward and downward turns in commodity prices may be gained from a study of the distributions in Table 129. Each of these includes 1110 individual observations on the timing of price movements during cyclical turns, the observations relating to 149 commodities during the ten cycles which occurred between 1890 and 1925.[1]

The distribution of observations relating to the timing of revival (which are drawn from the first ten of the eleven periods of revival which have been studied) is shown graphically in Figure 61. The story of revival which this distribution tells is of scattered advances which precede by many months the up-turn in the general price index. The number of price advances increases steadily as the origin (i. e. the date of up-turn in the general index) becomes closer. The heaviest advance has come within the three-month interval centering at the reference date, but for nine months thereafter the advance has been general. It is within this twelve-month period, which runs from 1.5 months before the base date to 10.5 months after that date, that the bulk of all commodities have felt the effects of revival. The entries within this interval, in the distribution of 1110 individual observations, constitute 55 per cent of the total. Following this period of general advance there is a sharp falling off in the number of commodities turning upward in price, but advances continue. The tail of the distribution shown in Figure 61 tapers off to zero at a deviation of 37.5 months from

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[1] This list of 119 commodities includes only those articles which passed through five or more cycles between 1890 and 1925, and which were not classed as "exceptional" in their price movements during business cycles. See p. 128 for a detailed description of this group.

TABLE 129

The Timing of Price Revival and Price Recession

Frequency Tables Showing Distributions of 1110 Observations on 149 Commodity Price Series during Ten Cycles

(1) Time of price turn (expressed as a deviation in months from the turning point of the all commodities index)[1]	(2) Frequency (periods of revival)	(3) Frequency (periods of recession)
—40.50 to —37.51		2[2]
—37.50 to —34.51		
—34.50 to —31.51		
—31.50 to —28.51		
—28.50 to —25.51	3	
—25.50 to —22.51	2	2
—22.50 to —19.51	2	9
—19.50 to —16.31	21	9
—16.50 to —13.51	23	28
—13.50 to —10.51	40	40
—10.50 to — 7.51	75	78
— 7.50 to — 4.51	67	95
— 4.50 to — 1.51	90	124
— 1.50 to + 1.49	188	211
+ 1.50 to + 4.49	166	167
+ 4.50 to + 7.49	133	129
+ 7.50 to +10.49	124	71
+10.50 to +13.49	49	61
+13.50 to +16.49	29	46
+16.50 to +19.49	40	17
+19.50 to +22.49	25	15
+22.50 to +25.49	12	3
+25.50 to +28.49	6	3
+28.50 to +31.49	11	
+31.50 to +34.49	2	
+34.50 to +37.49	2	
Totals	1110	1110

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[1] The minus sign (—) indicates a lead, the plus sign (+) indicates a lag with reference to the general price index.

[2] The two extreme entries in this table relate to the movements of zinc prices during period 16 (the period of recession for which the reference date is September, 1918). Zinc slab reached its war-time peak in June, 1915, and zinc sheet reached its peak in July, 1915, these being respectively 39 and 38 months before the reference date.

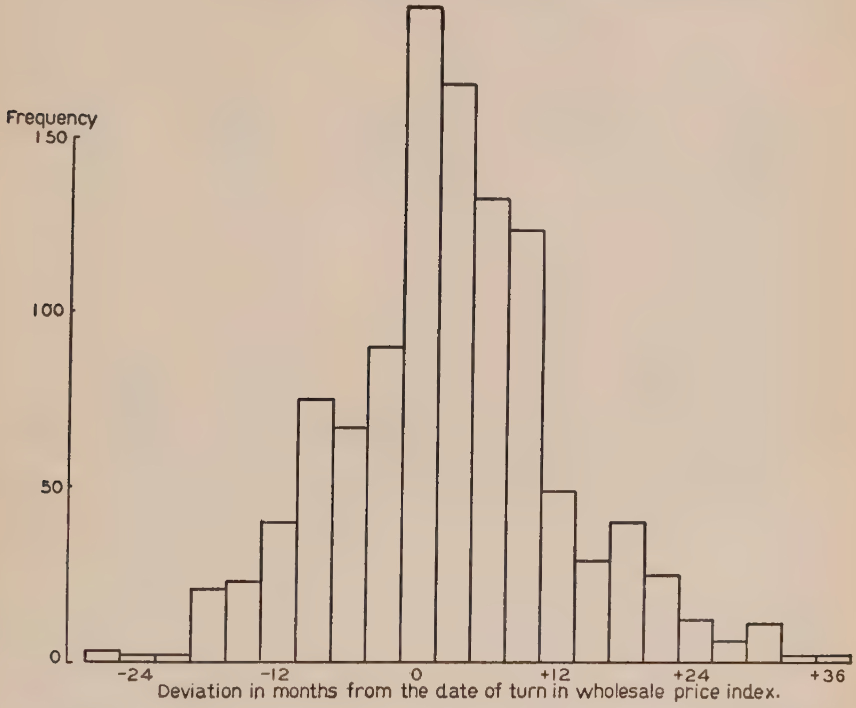
the base date (i. e. after the base date). The standard deviation of this distribution is 9.6 months.

A more detailed view of these periods of price rise is furnished by the graphs of the separate distributions which are plotted in Figure 62. Here one may compare the straggling advance which began in 1897 with the symmetrical and nicely balanced advance which began in 1901. Or the compact and sharply terminated advance of 1919 may be contrasted with the square central block

FIGURE 61

THE TIMING OF PRICE REVIVAL.

Column Diagram Showing the Distribution of 1110 Observations on Individual Commodity Price Series.



which marks the steady and uninterrupted flow of rising prices between the spring of 1921 and the end of 1922. The latter distribution is unique in the massive central concentration and in the absence of tapering extremities.

Averages and measures of variation relating to the several distributions discussed above are summarized in Table 130.

A study of the measures describing distributions for separate periods reveals points of similarity and difference between price revivals. During three revivals the average date of up-turn in the individual commodity price series has preceded the turn in the general index of wholesale prices. These were the revivals of 1892, 1895 and 1901. In each of the remaining eight revivals the average of the individual turning points has come later in time than the turning point of the price index, the amount of lag varying from

TABLE 130

THE TIMING OF PRICE REVIVAL

Averages and Measures of Variation for Eleven Periods of Revival, with Corresponding Measures based on 1110 Individual Observations drawn from the first Ten of the Periods listed

(1) Period[1]	(2) No. of observations	(3) Mean	(4) Standard deviation
1 (May, 1892)	140	— 1.8	7.8
3 (Mar., 1895)	148	— 2.8	7.3
5 (May, 1897)	200	+ 5.8	14.8
7 (July, 1901)	163	— 1.0	10.6
9 (July, 1904)	166	+ 5.7	11.8
11 (Feb., 1908)	165	+10.7	9.8
13 (June, 1911)	165	+ 6.1	8.7
15 (Nov., 1914)	198	+ 4.8	10.1
17 (Feb., 1919)	161	+ 1.6	6.2
19 (Jan., 1922)	184	+ 1.2	7.5
21 (June, 1924)	136	+ .9	7.6
Selected series, first ten periods[2]	1110	+ 2.6	9.6

[1] The entries in parentheses are the reference dates for the several periods.

[2] See pp. 128-129 for an explanation of the principle of selection. The observations entering into this distribution are not equal to the total of the observations for the individual phases of revival. Many of the price series represented in the distributions for specific periods of revival have been omitted from the selected list furnishing the 1110 observations.

less than one month to more than ten months. The average lag, as computed from 1110 individual observations relating to ten periods, has been 2.6 months. This figure relates to 149 selected series, not to the entire list. As was made clear in the earlier discussion, this lag is typical. The price index generally moves upward on revival as a result of advances in a limited number of commodities. If the bulk of the commodities are sagging slightly, or are stationary at a low level, advances in the prices of a small group of commodities will cause a rise in the index.

Not only do the averages of these distributions vary from cycle to cycle, but the degree of variation about the average varies, as is shown by the different values of the standard deviations given in column (4) of Table 130.[1] The most compact advance occurred during the revival of 1919 (standard deviation 6.2 months), while the most scattered advance was that for which the reference date is May, 1897 (standard deviation 14.8 months).

The distribution of individual observations on the timing of

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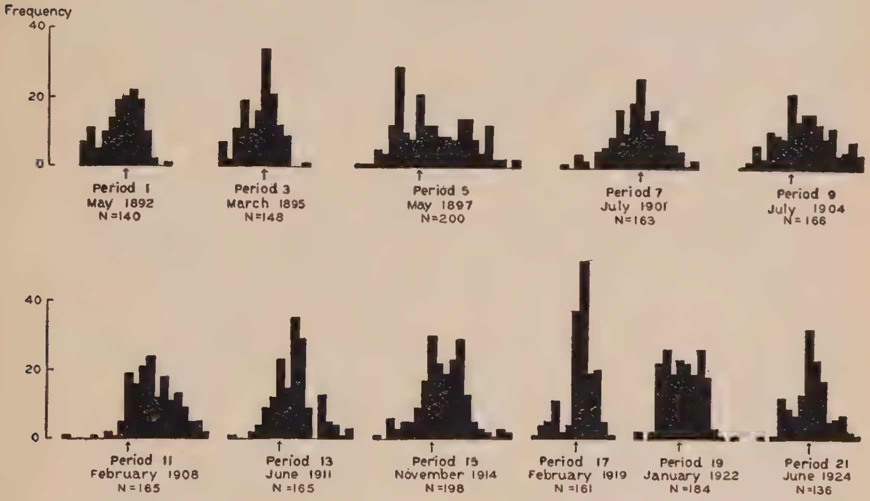
[1] In interpreting these differences the methods employed in securing the original observations, and differences in the periods as originally defined, must be borne in mind.

FIGURE 62

THE TIMING OF PRICE REVIVAL.

Column Diagrams of Distributions Relating to Eleven Periods of Revival.[1]



[1] The midpoint of the class centering at the origin (the date of turn in the wholesale price index) is indicated on the x-axis of each diagram by an arrow. The date of the origin is given below each diagram. The class interval is 3 months.

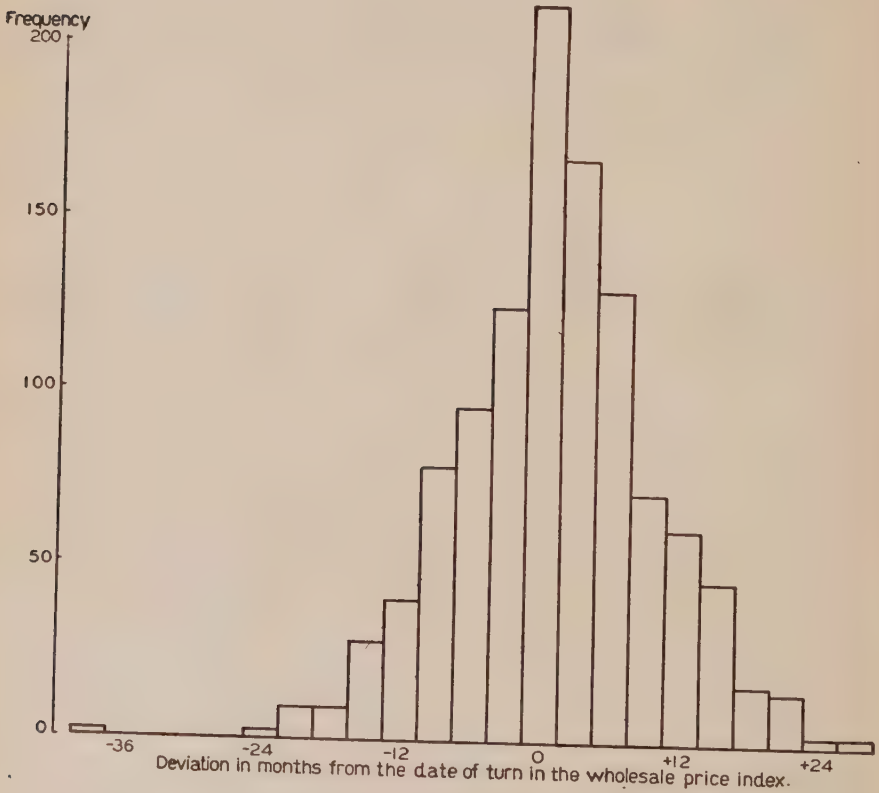
price recession, which was given in column (3) of Table 129, is shown graphically in Figure 63. The observations are drawn from ten periods of recession, occurring between 1892 and 1925. This distribution resembles very closely the distribution of measures relating to the timing of revival. It is fairly symmetrical (except for two cases at the lower limit of the range) and the concentration about the central tendency is pronounced. The standard deviation of this distribution is 8.4 months, as compared with 9.6 for the measures of revival. In general, the down-turn of prices which marks the recession phase of the cycle is more compact than is the upward movement of prices during revival.

It is very clear from this picture that recession does not strike the commodity markets in a single wave. This evenly balanced distribution indicates that many forces are affecting prices at such a time, and that they vary in strength with the passage of time. Viewing their effects in the aggregate, as we do in this distribution, we get a picture of a cumulative gain in intensity until the flood of falling prices has reached its maximum volume. Then comes a decline in the intensity of these forces, a regular subsidence, which is almost perfectly symmetrical with the preceding increase.

FIGURE 63

THE TIMING OF PRICE RECESSION.

Column Diagram Showing the Distribution of 1110 Observations on Individual Commodity Price Series.

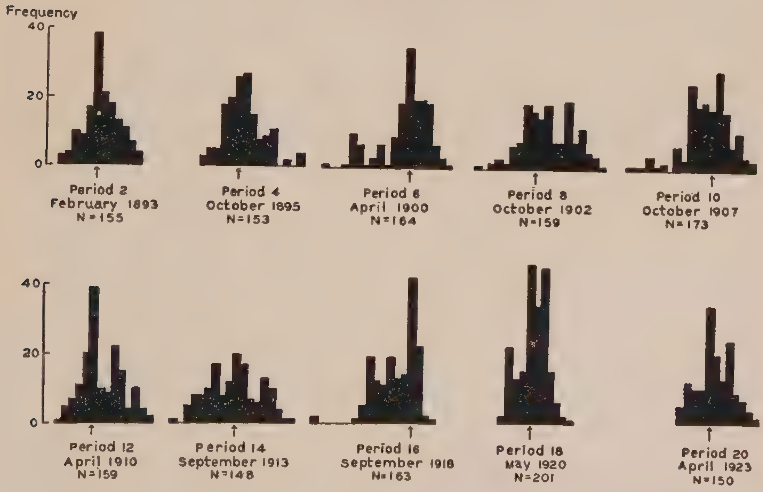


Distributions of measures relating to the timing of recession during ten separate cycles are represented by the column diagrams in Figure 64. These column diagrams will repay detailed examination, if the peculiarities of individual cycles are under investigation. The symmetrical and balanced distribution for the recession of 1893 stands in sharp contrast to the broken and uneven graph relating to the recession of 1900. There are distinct and important differences between the compact distribution for the recession of 1920 and the distribution for the recession of 1907. Both of these distributions have well-defined central masses, which indicate that the bulk of the decline was closely concentrated in each case. The distribution for 1907 has, however, a long tail extending to the left, representing declines which started while prosperity was still in full bloom, while another tail, extending to the right, represents a rather greater proportion of delayed price recessions than appeared after the recession of 1920-1921.

FIGURE 64

THE TIMING OF PRICE RECESSION.

Column Diagrams of Distributions Relating to Ten Periods of Recession.[1]



[1] The midpoint of the class centering at the origin (the date of turn in the wholesale price index) is indicated on the x-axis of each diagram by an arrow. The date of the origin is given below each diagram. The class interval is 3 months.

The arithmetic means and standard deviations of the distributions for the separate periods, and of the general distribution, are summrized in Table 131.

There is considerable variation from cycle to cycle in the values of these measures. The average time of recession varies from 3.6 months before the down-turn in the wholesale price index, in 1918, to 6.0 months after the turn in the index, in 1902. There is observable in these measures the same tendency for the average to lag behind the reference date as was found with the measures of revival, but it is much less pronounced. In four of the ten recessions the

TABLE 131

The Timing of Price Recession

Averages and Measures of Variation for Ten Periods of Recession, with Corresponding Measures based on 1110 Individual Observations drawn from all Periods

(1) Periods[1]	(2) No. of observations	(3) Mean	(4) Standard deviation
2 (Feb., 1893)	155	+2.1	7.4
4 (Oct., 1895)	153	+2.3	8.5
6 (Apr., 1900)	164	—1.4	10.1
8 (Oct., 1902)	159	+6.0	10.8
10 (Oct., 1907)	173	—1.8	9.9
12 (Apr., 1910)	159	+3.3	8.5
14 (Sept., 1913)	148	—1.2	10.8
16 (Sept., 1918)	163	—3.6	8.5
18 (May, 1920)	201	+1.3	6.0
20 (Apr., 1923)	150	+2.7	7.4
Selected series, all periods[2]	1110	+1.0	8.4

[1] The entries in parentheses are the reference dates for the several periods.
[2] See note 2, Table 130, concerning the selected series.

average down-turn in commodity prices came before the turn in the price index. The average of 1110 individual observations, relating to all recessions, is +1.0, indicating that the mean turning point in the individual price series came on recession just one month after the turn in the price index. (This may be compared with the value of +2.6, secured from the measures relating to the timing of revival.) The degree of compactness of the downward movement varies from the closely concentrated turn in 1920 (standard deviation 6.0 months) to the relatively scattered recession which centers at October, 1902 (standard deviation 10.8 months). Though the latter figure is relatively large, it is distinctly smaller than the largest standard deviation relating to the timing of revival. (This was 14.8 months, for the up-turn which began in 1897.) In the distributions relating to individual phases of revival and recession, as well as in the distributions composed of measures drawn from all cycles, there is found the same tendency toward greater concentration of price movements during recession than during revival.

The differences between the mean dates of revival and recession and the turning points of the general price index are attributable to several factors. In the first place, only 209 price series have been employed in this cyclical analysis. For the period since 1913 this falls considerably short of the total number of series included in the index of the Bureau of Labor Statistics, which has been used in defining the reference dates. Secondly, in the computation of the mean date of turn in each period account has been taken only of those commodities which shared in the given revival or recession. Those which showed no turn in prices were omitted from the calculations. These omitted commodities would, of course, affect a general price index. In the third place, no weights have been employed in deriving the mean turning points, while the Bureau's index is a weighted average.

But probably the most important reason for the differences is found in the nature of the averaging process by which the mean turning points have been defined. The usual price index is an average of the prices prevailing at a given date. (It is always compared, of course, with a similar average of the prices prevailing at some other date.) The mean turning points, as derived in the present analysis, represent averages of deviations *in time* from fixed reference points. The ordinary index may be thought of as an average in the computation of which account is taken of vertical deviations. In computing the average date of revival or recession account is taken of horizontal deviations. The two measures tell quite different stories. If interest attaches to movements of the general price level a customary price index would be employed. But if one wishes to determine the average date at which dealers in commodities at wholesale feel the effects of revival or recession, the measure based upon the actual time of the change in the price of each commodity possesses significance.

§ Price Movements, 1919-1923

To make these differences somewhat clearer, and to reveal in greater detail the nature of the price movements at two important turning points, the following distributions relating to the recession of 1920 and the revival of 1921-22 have been prepared. These are based upon a study of 371 price series for which monthly wholesale price quotations are given by the Bureau of Labor Statistics. The 371 entries include most of the 404 price series entering into the Bureau's index. A few series not included in that index (though quoted by the Bureau) have been used in the present examples, and a small number which do enter into the Bureau's index have been omitted because the quotations needed in defining the turning points were not available. These distributions are shown graphically in Figure 65.

Table 132

FREQUENCY TABLES SHOWING DISTRIBUTIONS OF A SELECTED LIST OF COMMODITIES CLASSIFIED ACCORDING TO DATES OF RECESSION AND REVIVAL DURING A POST-WAR BUSINESS CYCLE

(1) Time of price turn (expressed as a deviation in months from the date of turn of the Bureau of Labor Statistics Index)	(2) Frequency Recession of 1919–1921 (ref. date, May, 1920)[1]	(3)	(4) Frequency Revival of 1921-1923 (ref. date, Jan., 1922)[2]	(5)
	No.	Per cent	No.	Per cent
—19.50 to —16.51			2	.6
—16.50 to —13.51			0	.0
—13.50 to —10.51	3	.8	6	1.9
—10.50 to — 7.51	29	8.0	57	17.8
— 7.50 to — 4.51	25	6.9	36	11.2
— 4.50 to — 1.51	38	10.5	40	12.5
— 1.50 to + 1.49	96	26.5	35	10.9
+ 1.50 to + 4.49	64	17.6	40	12.5
+ 4.50 to + 7.49	75	20.6	33	10.3
+ 7.50 to +10.49	19	5.2	38	11.8
+10.50 to +13.49	10	2.8	25	7.8
+13.50 to +16.49	3	.8	5	1.5
+16.50 to +19.49	1	.3	3	.9
+19.50 to +22.49			0	.0
+22.50 to +25.49			1	.3
Totals	363	100.0	321	100.0

Descriptive measures

Recession		Revival	
Mean	+1.13 mos.	Mean	+ .44 mos.
Standard deviation	5.44 mos.	Standard deviation	7.52 mos.

---

[1] Eight of the 371 series studied have been omitted from this table because no dates of price turn could be defined. Of these 8 series, 1 was marked by constant prices, 5 by rising prices and 1 by sagging prices. The grade to which the price quotation referred was changed in the case of 1 article.

[2] Fifty of the 371 price series studied have been omitted from this table. Of these, 23 were constant in price and 27 were sagging in price during the period of this revival.

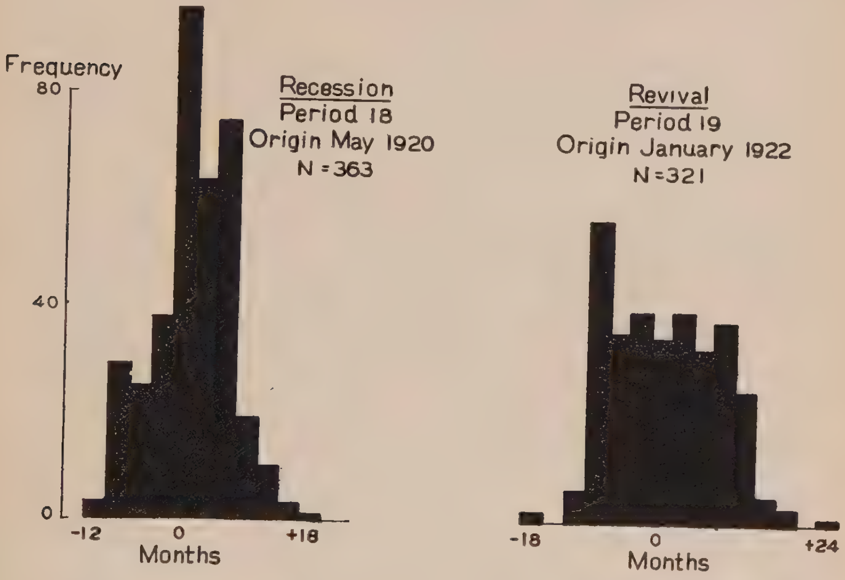
The inclusion of a greater number of cases gives us more satisfactory distributions for the two periods to which they relate, but in their general characteristics the distributions are not unlike those derived from the smaller number of observations previously employed. For the recession of 1920 we have the same picture of few and scattered declines beginning about a year before the general index turned downward. The volume of declining prices began to increase materially about the first of April, 1920, and continued in a steady flow during the nine-month period between April 1, 1920, and January 1, 1921. After the latter date there was a sharp fall in the number of recessions, although there were isolated instances of commodities which did not feel the effect of the general recession until 1921.

The story is perhaps more clearly told when the number of recessions occurring during each of these three periods is expressed as a percentage of the total. During the twelve months prior to April 1, 1920, 26 per cent of the total number of commodities which were affected by the recession reached their maximum prices and started to decline. During the nine months between April 1, 1920 and January 1, 1921, 65 per cent of the total number reached their turning points. In the twelve months of 1921, 9 per cent of the total number of commodities moved downward in price.

FIGURE 65

THE TIMING OF PRICE REVIVAL AND PRICE RECESSION.

Column Diagrams Showing Distributions of Wholesale Price Series Classified according to the Date of Recession (1919-1921) and the Date of Revival (1921-1923).



The mean date of decline came 1.13 months after the turning point in the index of the Bureau of Labor Statistics. This places it approximately at June 19, 1920. The standard deviation is 5.44 months.

The picture of the ensuing price revival reveals a much less concentrated turn in prices. There was a steady upward movement of prices during the 24 months between March 1, 1921, and March 1, 1923. (This includes the eight central classes in which the frequencies are heaviest.) The movement was somewhat stronger during the early part of this period than it was toward the end, but there was no pronounced slackening until the end of the period of 24 months. During this time 95 per cent of the total number of price up-turns occurred. The mean date of revival is +.44, approximately half a month after the up-turn in the general price index. The standard deviation is 7.52 months, a measure materially greater than the corresponding figure of 5.44 for the preceding recession.

b. *The Duration of Periods of Price Revival and Recession.* Although the distributions of measures defining the duration of cyclical price movements vary somewhat in form from period to period, there is a fairly distinct type which predominates. This type is exemplified by the following distributions, secured by combining 1110 individual measures of duration of price rise and price fall, relating to 149 commodity price series. In securing these measures account has been taken only of those price movements which occurred between successive dates of revival and recession.

TABLE 133

Duration of Cyclical Price Movements

Frequency Tables Showing Distributions of 1110 Observations on 149 Commodity Price Series during Ten Cycles

(1) Duration of price movement (from low to ensuing high or from high to ensuing low) in months	(2) Frequency (periods of price rise)	(3) Frequency (periods of price fall)
.50 to 3.49	32	57
3.50 to 6.49	79	107
6.50 to 9.49	102	100
9.50 to 12.49	94	133
12.50 to 15.49	95	134
15.50 to 18.49	111	130
18.50 to 21.49	93	121
21.50 to 24.49	73	108
24.50 to 27.49	68	71
27.50 to 30.49	74	57
30.50 to 33.49	72	37
33.50 to 36.49	49	17
36.50 to 39.49	35	11
39.50 to 42.49	39	14
42.50 to 45.49	24	1
45.50 to 48.49	24	6
48.50 to 51.49	11	2
51.50 to 54.49	19	2
54.50 to 57.49	7	2
57.50 to 60.49	5	
60.50 to 63.49	1	
63.50 to 66.49	3	
Totals	1110	1110

The distribution of measures relating to the duration of price rise is plotted as a column diagram in Figure 66. The positive skewness is pronounced. The duration of rise for the bulk of the entries is relatively short, but the distribution tapers out in a long tail to the right.

Distributions for the separate periods are shown in Figure 67.[1] With three exceptions these are all of the same type as the general

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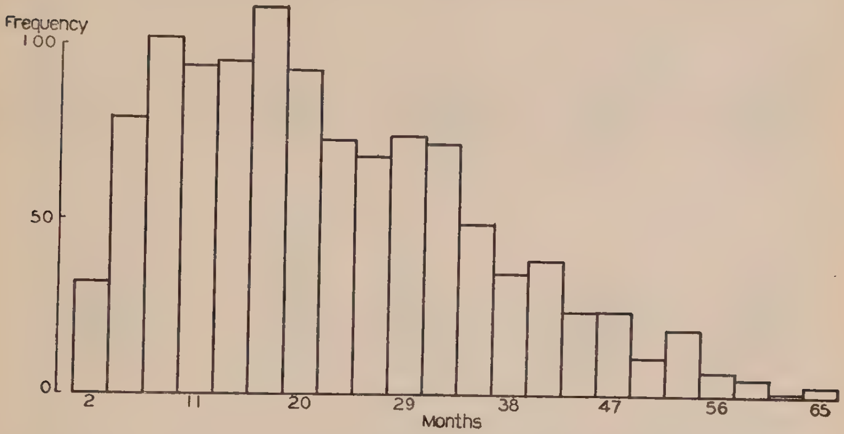
[1] The distributions for the separate periods include all the commodities sharing in the given price revivals. They are not limited to the 149 commodities entering into the distribution shown in Table 133.

FIGURE 66

THE DURATION OF PRICE RISE DURING REVIVAL AND PROSPERITY.

Column Diagram Showing the Distribution of 1110 Observations on Individual Commodity Price Series.



distribution shown above. The exceptions relate to the revivals for which the reference dates fall in 1897, in 1904 and in 1914. The distributions for these periods are fairly symmetrical, standing in sharp contrast to the skew distribution which appears to be typical. In each of these periods, it may be noted, the duration of the phase of revival was long, both in months and in proportion to the length of the cycle of which it was a part.

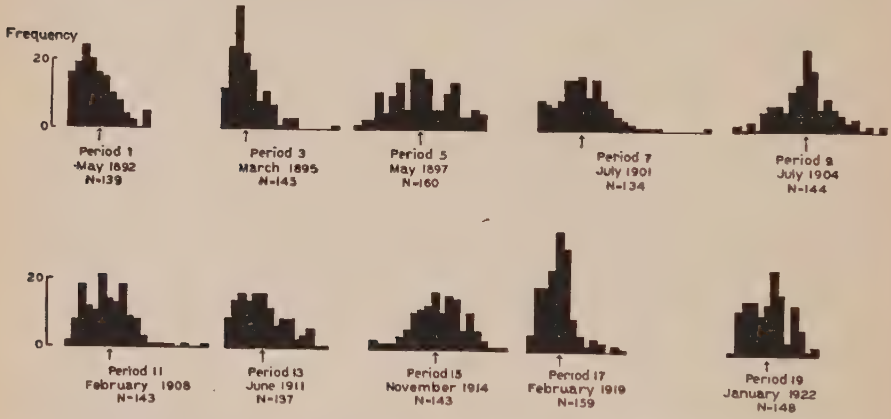
There is a suggestion here that the prolongation of a period of revival gives opportunity for those forces which tend to produce symmetry in a distribution to work themselves out. When the general price advance continues for a sufficiently long period, the wide variety of forces which initiate and check the advances of individual commodity prices produce a semblance of balance in their cumulative action upon a considerable number of price series. This was true during the advance from 1897 to 1900, from 1904 to 1907, from 1914 to 1918. Normally, during the shorter advances of most revivals, there is an unbalanced advance, of the type represented by the distribution shown in Figure 66. This lack of balance is evidenced by a pronounced tailing out above the mode, with no corresponding frequencies below the mode.

Differences between periods of revival in respect to the duration of price rise are clearly revealed by the summary in Table 134 of the

FIGURE 67

The Duration of Price Rise during Revival and Prosperity.

Column Diagrams of Distributions Relating to Ten Periods of Revival and Prosperity.[1]



[1] The means and standard deviations of these distributions are given in Table 134. The location of the mean on the x-axis of each diagram is indicated by an arrow. The class interval is 3 months, centering at 2, 5, 8, etc.

The date below each diagram defines the reference point for the given period.

measures descriptive of the various distributions. The point may again be emphasized that the measures in this table relate only to those commodities which reflect specific revivals, a number which varies from period to period. As in the preceding table the measures of duration apply to price increases which occurred between successive dates of revival and recession. The averages given in column (3) of this table are presented graphically in the upper half of Figure 68.

The period of rising prices has varied from an average of 11.7 months, in the revival which began early in 1895, to an average of 39.5 months, in the revival for which the reference date is November, 1914. When the various individual observations relating to 149 commodity price series are cast into a single distribution, an average of 22.2 months is obtained. This is based upon 1110 observations. The average rise was exceptionally short during the revivals which began in 1892, in 1895 and in 1919, and exceptionally long in the revivals beginning in 1897, in 1904 and in 1914.

Figures giving the duration of periods of rise in the wholesale price index of the United States Bureau of Labor Statistics[1] have

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[1] Supplemented by Falkner's index for the period 1890-1899.

TABLE 134

DURATION OF PERIODS OF PRICE RISE DURING REVIVAL AND PROSPERITY

Averages and Measures of Variation derived from Observations on Individual Commodities, with Measures relating to an Index of Wholesale Prices

(1) Period[1]	(2) No. of observations	(3) Mean duration of rise (from low to ensuing high) in months	(4) Standard deviation, in months	(5) Coefficient of variation	(6) Duration of rise in wholesale price index, in months
1 (May, 1892)	139	12.7	8.2	64.1	9
3 (Mar., 1895)	145	11.7	7.6	64.9	7
5 (May, 1897)	160	29.9	12.9	43.3	35
7 (July, 1901)	134	23.1	11.7	50.4	15
9 (July, 1904)	144	31.7	12.1	38.2	39
11 (Feb., 1908)	143	19.5	10.2	52.4	26
13 (June, 1911)	137	19.9	10.1	50.7	27
15 (Nov., 1914)	143	39.5	11.4	28.9	46
17 (Feb., 1919)	159	14.0	7.1	50.7	15
19 (Jan., 1922)	148	18.1	8.6	47.5	15
Selected series, all periods[2]	1110	22.2	13.3	59.8	

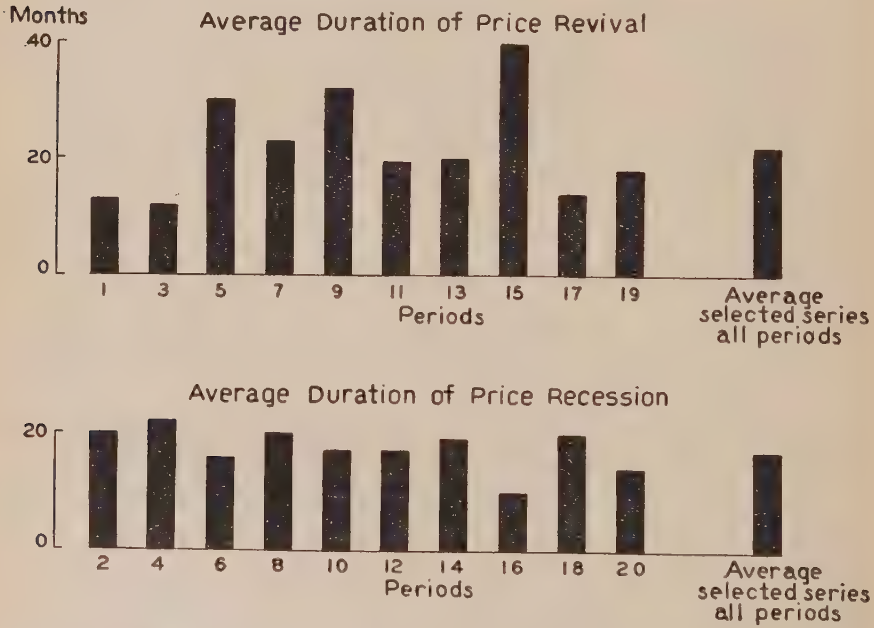
[1] The entries in parentheses are the reference dates for the several periods.
[2] See note 2, Table 130, concerning the selected series.

been placed in Table 134, for comparison with the averages derived from the duration measures for individual commodities. There is a general agreement between the two sets of figures, but certain rather considerable differences are found. Thus the price rise shown by the index for the revival following the 7th period (reference date July, 1901) lasted for 15 months. The average duration of rise as computed from the individual measures for this period was 23.1 months. One reason for the difference is found in the fact that the price index for a given date represents a cross-section of the price situation at that date. A change in the value of the index between any two dates is a net change. Diverse movements may cancel, or partially cancel, each other. In averaging the duration measures for individual commodities there is no off-setting of this character. Each movement is given full weight in arriving at the average. Again, the price index measures the net change in all commodities, whereas the average of the individual commodity measures is based only upon those commodities which actually rose in price.

Whether the measure of duration given by the index or the average secured from the individual records should be accepted in a given case depends upon the purpose in mind. If interest attaches to changes in the price level the record of the index would be employed. If the extent of the disturbance in individual commodity prices is of interest, the average of the separate measures has distinct significance.

FIGURE 68

Averages Measuring the Duration of Periods of Price Revival and Price Recession during Ten Cycles.

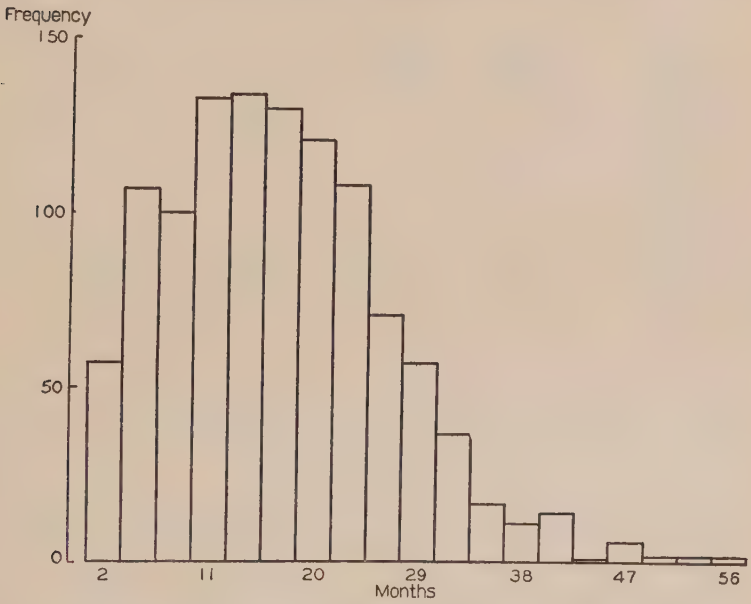


The variation of the individual observations on duration of rise was least during the rise beginning in 1919 (standard deviation 7.1 months). The variation was greatest during the rise which began in 1897 (standard deviation 12.9 months). As measured in absolute terms, the degree of variation tends to increase with an increase in the average duration of rise. The coefficient of variation, measuring the relative spread, shows a reverse tendency.

There are some differences between the distributions of measures of the duration of rise and measures of duration of fall, although the general distributions are of much the same type. The class frequencies for the distribution relating to price recessions were given in column (3) of Table 133. The distribution is shown graphically in Figure 69.

FIGURE 69

THE DURATION OF PRICE FALL DURING RECESSION AND DEPRESSION. Column Diagram Showing the Distribution of 1110 Observations on Individual Commodity Price Series.



This distribution, like most of those previously presented, is skewed in a positive direction. The bulk of the observations are concentrated near the lower end of the scale, and a tail extends to the right. The skewness is less, however, than that of the distribution relating to duration of price rise.

The distributions of duration measures for individual cycles, which appear in Figure 70, approximate this general type. The measures descriptive of these distributions appear in the following table. The averages given in column (3) are presented graphically in the lower half of Figure 68.

The average length of the period of price decline has varied from 10.3 months, for the recession which began in 1918, to 21.6 months, for the recession which began in the latter part of 1895. The average for the ten periods of recession, as computed from 1110

TABLE 135

DURATION OF PERIODS OF PRICE FALL DURING RECESSION AND DEPRESSION

Averages and Measures of Variation derived from Observations on Individual Commodities, with Measures relating to an Index of Wholesale Prices

(1) Period[1]	(2) No. of observations	(3) Mean duration of fall (from high to ensuing low) in months	(4) Standard deviation, in months	(5) Coefficient of variation	(6) Duration of fall in wholesale price index, in months
2 (Feb., 1893)	121	20.2	8.2	40.9	25
4 (Oct., 1895)	149	21.6	12.6	58.1	19
6 (Apr., 1900)	156	15.5	8.9	57.2	15
8 (Oct., 1902)	149	19.6	11.6	59.3	21
10 (Oct., 1907)	154	16.7	9.1	54.4	4
12 (Apr., 1910)	142	17.1	7.7	45.1	14
14 (Sept., 1913)	148	18.6	9.1	48.9	14
16 (Sept., 1918)	161	10.3	7.8	76.0	5
18 (May, 1920)	181	20.0	6.7	33.7	20
20 (Apr., 1923)	122	13.9	7.1	51.2	14
Selected series, all periods[2]	1110	17.0	9.6	56.5	

[1] The entries in parentheses are the reference dates for the several periods.
[2] See note 2, Table 130, concerning the selected series.

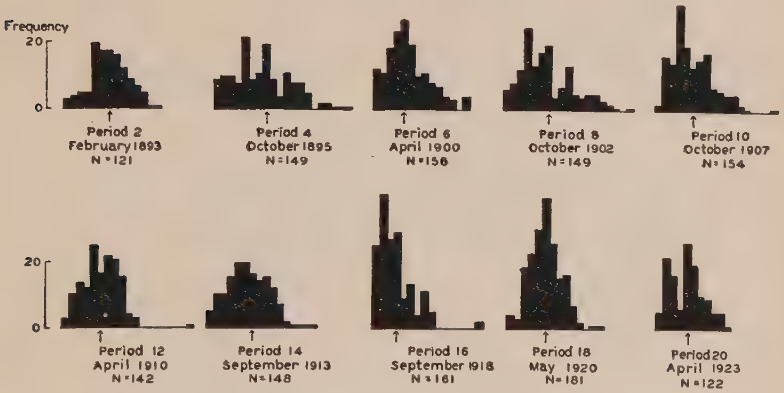
observations relating to 149 commodities, has been 17.0 months. In two respects these figures stand in sharp contrast to those relating to the duration of price rise. The average is distinctly shorter (17.0 as compared with 22.2), and the variation from cycle to cycle in the length of the period of decline is distinctly less than the variation from cycle to cycle in the duration of the period of price rise. This latter difference is brought out clearly by a comparison of the graphs in the upper and lower portions of Figure 68.

As in respect to duration of rise, there are certain differences between the measures of duration of decline derived from the general index of wholesale prices and the averages derived from individual commodity records. The duration of decline in the 10th period, the recession for which the reference date is October, 1907, was only 4 months as measured by the price index, but the average computed from the individual records is 16.7 months. The offsetting influence of conflicting price movements is responsible for the very short period of decline in the price index. The higher figure probably gives a truer account of the duration of the downward movements in the prices of those commodities which were affected by this recession.

FIGURE 70

THE DURATION OF PRICE FALL DURING RECESSION AND DEPRESSION.

Column Diagrams of Distributions Relating to Ten Periods of Recession and Depression.[1]



[1] The means and standard deviations of these distributions are given in Table 135. The location of the mean on the x-axis of each diagram is indicated by an arrow. The class interval is 3 months, centering at 2, 5, 8, etc. The date below each diagram defines the reference point for the given period.

The variation of the individual observations about the mean was least for the recession beginning in 1920 (standard deviation 6.7 months). This was a compact downward movement, marked by a relatively close approach to uniformity in the duration of decline. This figure is smaller than any of the corresponding measures relating to duration of price rise. The absolute variation was greatest during the recession which began in 1895 (standard deviation 12.6 months).

As measured in absolute units (i. e. in months) the variation in duration of decline is less than the variation in duration of rise in 8 of the 10 cycles to which the above figures relate. The downward movements of commodity prices during business cycles are not only shorter, on the average, than the up-swings, but the recessions are more compact in respect to duration than are the upward movements.[1]

c. *The Degree of Price Change during Revival and Recession.* As in respect to all other aspects of price behavior, there is considerable variation in the degree to which prices rise during revival and decline during recession. The extent and character of the variation during revival may be appreciated from an inspection of the following distribution, based upon 1110 individual cases of price rise, occurring during ten periods of revival. (This distribution includes only those commodities which did rise in price during specific periods of revival. Account has been taken in earlier summaries of those commodities which did not share in these cyclical movements.) The increase is expressed in each case as a percentage of the ensuing high value. The distribution is shown graphically in Figure 71.

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[1] There is approximate equality in the matter of variation if coefficients of variation instead of standard deviations be compared. The comparison in terms of months seems more significant for the present purpose.

TABLE 136

Degree of Price Increase during Revival and Prosperity

Frequency Table Showing the Distribution of 1110 Observations on 149 Commodity Price Series during Ten Periods of Revival and Prosperity

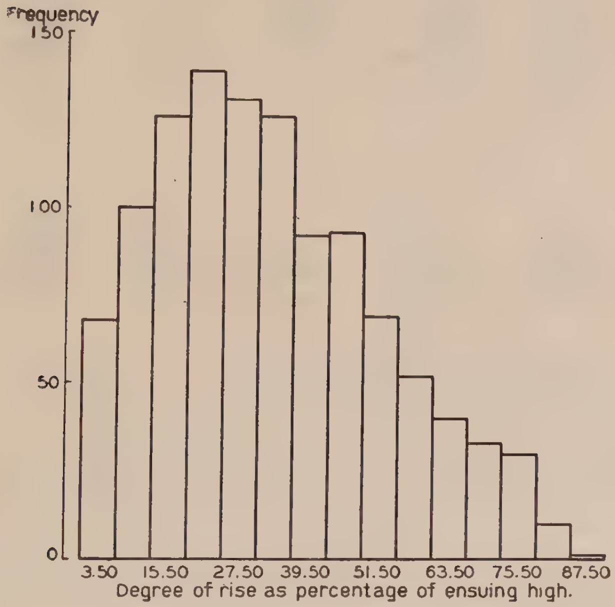
Degree of rise (as a percentage of the ensuing high)	Frequency
.50 to 6.49	68
6.50 to 12.49	100
12.50 to 18.49	126
18.50 to 24.49	139
24.50 to 30.49	131
30.50 to 36.49	126
36.50 to 42.49	92
42.50 to 48.49	93
48.50 to 54.49	69
54.50 to 60.49	52
60.50 to 66.49	40
66.50 to 72.49	33
72.50 to 78.49	30
78.50 to 84.49	10
84.50 to 90.49	1
Total	1110

This distribution is positively skewed, resembling in this respect distributions secured from many other measures of price behavior. There is marked concentration at the lower end of the scale. The modal increase, as defined by the crude mode, was 21.5 per cent (true mode 19.3) and the mean increase was 32.8 per cent. (This latter value is equivalent to an increase of about 50 per cent of the low price preceding the rise, or of about 39 per cent of the average of high and low prices.) The variation about the mean is considerable, as is evidenced by a standard deviation of 19.2 and a coefficient of variation of 58.7.

FIGURE 71

THE DEGREE OF PRICE RISE DURING REVIVAL AND PROSPERITY.

Column Diagram Showing the Distribution of 1110 Observations on Individual Commodity Price Series.

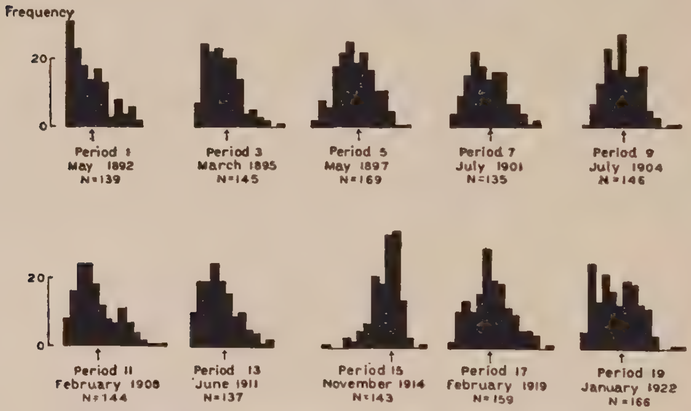


The frequency distributions composed of measures of price increase relating to individual cycles, which are shown in Figure 72, are in general positively skewed. There is a tendency toward symmetry during certain periods (in the revivals for which the reference dates fall in 1897, in 1901, in 1904 and in 1919), and in one case, during the war-time advance, a negatively skewed distribution is obtained. Extreme advances predominated and small gains were the exception at this time.

The changes from cycle to cycle in the matter of price rise are revealed by the summary in Table 137 of means and measures of variation. Corresponding percentages of increase in the general index of wholesale prices (U. S. Bureau of Labor Statistics, supplemented by Falkner's) are included for the purpose of comparison. The averages in column (3) of this table are shown graphically in the upper portion of Figure 73.

FIGURE 72

THE DEGREE OF PRICE RISE DURING REVIVAL AND PROSPERITY. Column Diagrams of Distributions Relating to Ten Periods of Revival and Prosperity.[1]



[1] The degree of rise, expressed as a percentage of the ensuing high, is measured on the x-scale. The means and standard deviations of the several distributions are given in Table 137. The location of the mean on the x-axis of each diagram is indicated by an arrow. The class interval is 6, centering at 2.5, 8.5, etc.

The date below each diagram defines the reference point for the given period.

The average degree of rise in price, expressed as a percentage of the ensuing high values, has varied from 20.6 during the revival

TABLE 137

DEGREE OF PRICE RISE DURING REVIVAL AND PROSPERITY

Averages and Measures of Variation derived from Observations on Individual Commodities, with Measures relating to an Index of Wholesale Prices[1]

(1) Period[2]	(2) No. of observations	(3) Mean	(4) Standard deviation	(5) Coefficient of variation	(6) Degree of rise in wholesale price index
1 (May, 1892)	139	20.6	16.2	78.4	3.1
3 (Mar., 1895)	145	24.4	14.0	57.5	1.9
5 (May, 1897)	169	37.9	16.5	43.5	20.0
7 (July, 1901)	135	31.1	15.8	50.6	14.3
9 (July, 1904)	146	32.9	14.4	43.6	12.5
11 (Feb., 1908)	144	28.3	18.3	64.6	16.2
13 (June, 1911)	137	25.1	15.1	60.4	11.5
15 (Nov., 1914)	143	66.1	12.1	18.3	52.5
17 (Feb., 1919)	159	34.5	19.9	57.7	21.6
19 (Jan., 1922)	166	30.7	17.2	55.9	12.9
Selected series, all periods[3]	1110	32.8	19.2	58.7	

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[1] The entries in columns (3), (4), and (6) are in percentages, the bases of the percentages being the high values succeeding the rises in the several periods.

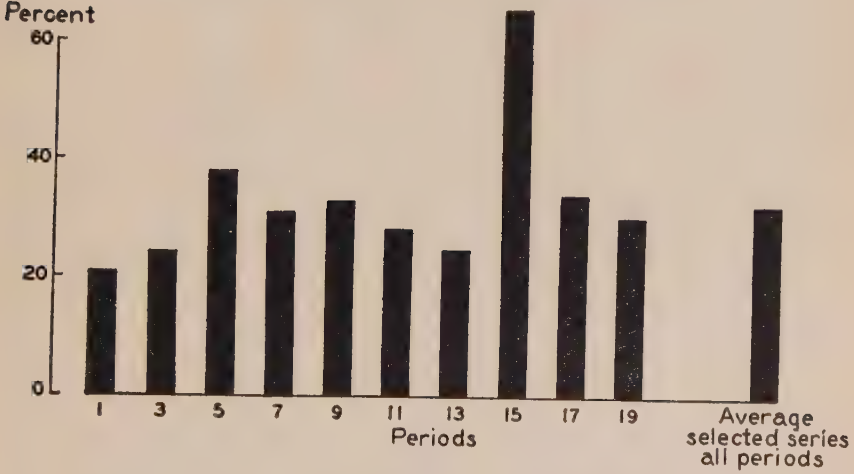
[2] The entries in parentheses are the reference dates for the several periods.

[3] See note 2, Table 130, concerning the selected series.

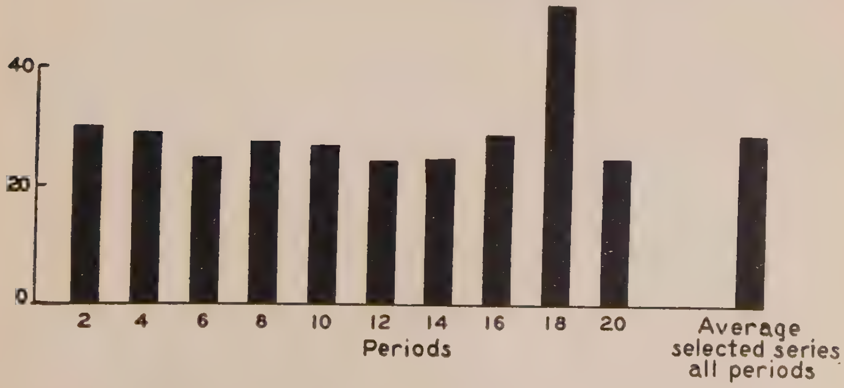
beginning in 1892, to 66.1 during the industrial expansion of the war period. These averages are in all cases greater than the percentages of rise recorded by the general price index, the differences being pronounced in one or two instances. In the revival which culminated late in 1895 the price index shows an advance of but 1.9 per cent, but the average percentage of rise in the prices of 145 commodities was 24.4 per cent. A large part of the difference is

FIGURE 73

Averages Measuring the Degree of Price Rise and Price Decline During Ten Cycles.



Average Degree of Price Rise during Revival
(As percentage of ensuing high)



Average Degree of Price Decline during Recession
(As percentage of preceding high)

due to the fact that in the computation of the latter figure only those commodities have been included which shared in the advance. The offsetting influence of the commodities which fell in price or remained constant (these groups making up some 30 per cent of the total in this case) is in part responsible for the small increase registered by the general index. Perhaps more important in tending to reduce the change in the index is the fact that the price advances of particular commodities were not concurrent, and the resulting irregularities of movement in part neutralized each other.

The degree of variation in the percentage of rise, as measured by the standard deviation, has not varied greatly from cycle to cycle. It was least (12.1) in the rise which began in 1914. This was the most compact upward movement, in respect to amount of change, which we have recorded. The variation of the individual observations was greatest (standard deviation 19.9) in the rise which began in 1919. For all other periods the measures varied between 14 and 18. The coefficients of variation vary between wider limits.

The general distribution of measures of price decline during recession and depression differs somewhat from the distribution of measures of price increase. The table which follows gives the details of this distribution, which appears in graphic form in Figure 74. The observations relate to the 149 selected price series which have been employed in previous examples.

TABLE 138

Degree of Price Fall during Recession and Depression

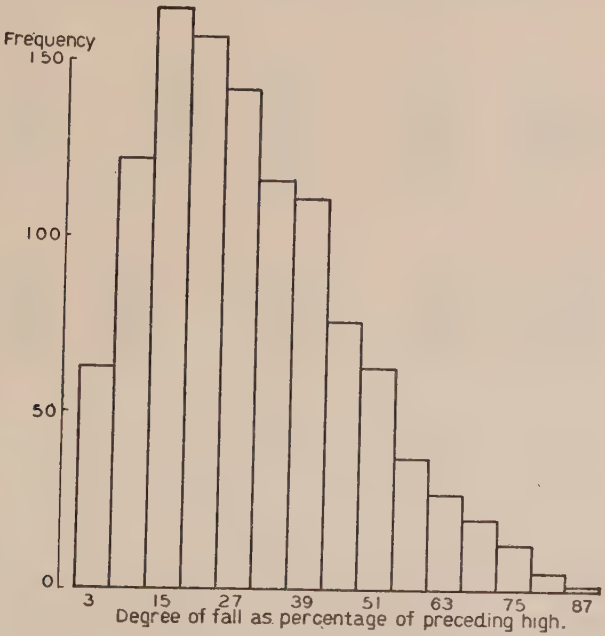
Frequency Table Showing the Distribution of 1118 Observations on 149 Commodity Price Series during Ten Periods of Recession and Depression

Degree of fall (as a percentage of the preceding high)	Frequency
.00 to 5.99	63
6.00 to 11.99	122
12.00 to 17.99	165
18.00 to 23.99	157
24.00 to 29.99	142
30.00 to 35.99	116
36.00 to 41.99	111
42.00 to 47.99	76
48.00 to 53.99	63
54.00 to 59.99	37
60.00 to 65.99	27
66.00 to 71.99	20
72.00 to 77.99	13
78.00 to 83.99	5
84.00 to 89.99	1
Total	1118

This distribution has the positive skewness which characterized the distribution of measures of price increase. The average percentage of price decline is 28.9, which is lower than the average percentage of price increase (32.8). (The averages are comparable, since the individual percentages of rise and decline are measured from the same base. The mean decline would be approximately 34 per cent of the average of high and low prices.) The differences between individual measures of price decline are somewhat less than the differences between measures of price increase, when the variation is measured in absolute units. The standard deviation has a value of 17.3 for the above distribution, as compared with 19.2 for the distribution of measures of degree of price rise during revival. The coefficients of variation are of almost equal value, however (59.7 for the measures of price fall, and 58.7 for the measures of price increase).

FIGURE 74

THE DEGREE OF PRICE DECLINE DURING RECESSION AND DEPRESSION. Column Diagram Showing the Distribution of 1118 Observations on Individual Commodity Price Series.

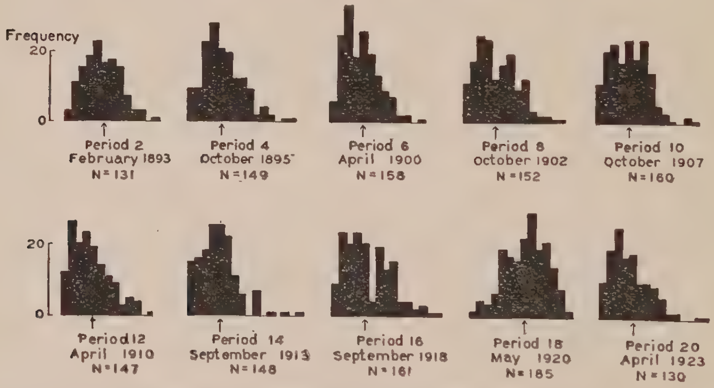


The distributions relating to individual phases of recession are shown in Figure 75. The positive skewness found in the general distribution is characteristic of all these diagrams, with the single exception of that relating to the down-swing of 1920-21, which is negatively skewed. Extreme declines predominated during this recession, and minor declines were relatively few.

FIGURE 75

THE DEGREE OF PRICE DECLINE DURING RECESSION AND DEPRESSION.

Column Diagrams of Distributions Relating to Ten Periods of Recession and Depression.[1]



[1] The degree of fall, expressed as a percentage of the preceding high, is measured on the x-scale. The means and standard deviations of these distributions are given in Table 139. The location of the mean on the x-axis of each diagram is indicated by an arrow. The class interval is 6, centering at 2.5, 8.5, etc.
The date below each diagram defines the reference point for the given period.

Averages and measures of variation for these various distributions are summarized in Table 139, together with measures of the degree of decline of the general price index (U. S. Bureau of Labor Statistics, supplemented by Falkner's) during the various recessions. The averages in column (3) of this table are shown graphically in the lower portion of Figure 73.

The degree of recession is in general less than the degree of rise, which follows, of course, from the fact that the general course of prices was upward during most of the period covered. In only three of the ten recessions did the average fall exceed the preceding rise. These were the recessions beginning in 1893 and 1895, which came when the trend of general prices was downward, and the recession of 1920-21.

The average decline, as measured by the figures in column (3),

TABLE 139

Degree of Price Decline during Recession and Depression

Averages and Measures of Variation derived from Observations on Individual Commodities, with Measures relating to an Index of Wholesale Prices[1]

(1) Period[2]	(2) No. of observations	(3) Mean	(4) Standard deviation	(5) Coefficient of variation	(6) Degree of decline in wholesale price index
2 (Feb., 1893)	131	29.8	14.6	49.1	12.9
4 (Oct., 1895)	149	28.8	16.5	57.3	7.4
6 (Apr., 1900)	158	24.6	14.1	57.3	4.9
8 (Oct., 1902)	152	27.4	16.5	60.3	7.7
10 (Oct., 1907)	160	26.8	15.5	57.6	8.3
12 (Apr., 1910)	147	24.3	15.6	64.2	14.3
14 (Sept., 1913)	148	24.7	15.7	63.5	4.7
16 (Sept., 1918)	161	29.0	18.8	64.8	5.2
18 (May, 1920)	185	51.8	17.1	33.1	43.9
20 (Apr., 1923)	130	24.6	16.1	65.4	8.9
Selected series, all periods[3]	1118	28.9	17.3	59.7	

---

[1] The entries in columns (3), (4) and (6) are in percentages, the bases of the percentages being the high values preceding the declines in the several periods.

[2] The entries in parentheses are the reference dates for the several periods.

[3] See note 2, Table 130, concerning the selected series.

is greater in all cases than the corresponding decline in the wholesale price index. The reasons for this have been suggested above.

As in respect to the duration measures, the average percentage of decline is more uniform from cycle to cycle than is the average percentage of rise. With the exception of the great recession of 1920-21, the degree of decline has varied between 24 per cent and 30 per cent.

d. *The Duration of Cycles in Commodity Prices.* Measures of the duration of commodity price cycles may be combined in frequency distributions relating to specific cycles, or into a general distribution for all cycles. When all the duration measures for 149 selected commodities are combined we have the distribution given in Table 140. This is shown graphically in Figure 76.

The 1110 cycles, classified according to duration, form a distribution with a fairly regular increase in frequencies up to a mode at 35 months and an even decline in frequencies thereafter. There is some concentration near the lower end of the scale, giving a positive skewness to the distribution. The mean length of the price cycle for these commodities, during the period 1890-1925, was 39.2 months, and the standard deviation was 12.9 months.

TABLE 140

DURATION OF CYCLES IN COMMODITY PRICES

Frequency Table Showing the Distribution of 1110 Observations on 149 Commodity Price Series during Ten Business Cycles

Duration of cycle[1] (from low to ensuing low) in months	Frequency
7.50 to 12.49	7
12.50 to 17.49	27
17.50 to 22.49	61
22.50 to 27.49	115
27.50 to 32.49	139
32.50 to 37.49	186
37.50 to 42.49	167
42.50 to 47.49	124
47.50 to 52.49	122
52.50 to 57.49	67
57.50 to 62.49	52
62.50 to 67.49	15
67.50 to 72.49	15
72.50 to 77.49	8
77.50 to 82.49	2
82.50 to 87.49	2
87.50 to 92.49	0
92.50 to 97.49	1
Total	1110

[1] In interpreting these figures the method by which the original measures were obtained must be borne in mind. The procedure is explained in detail in Chapter I.

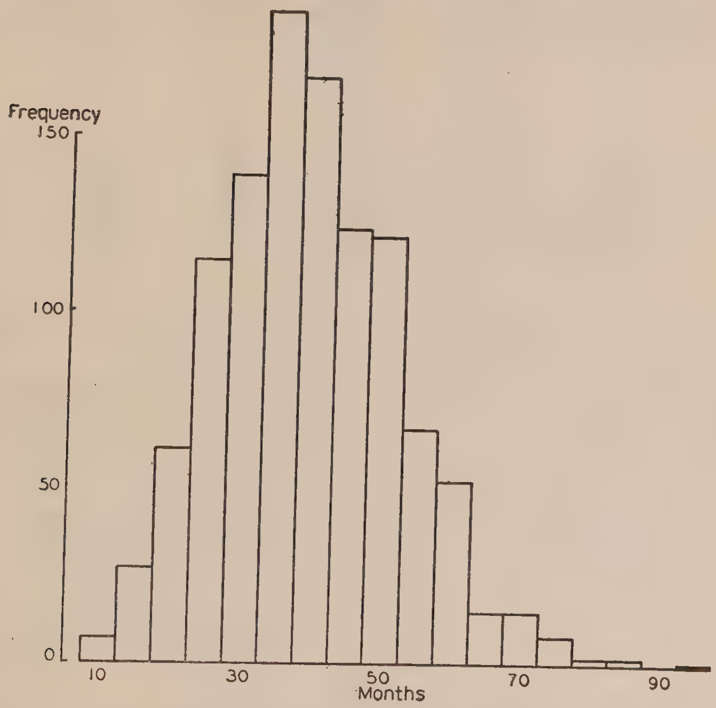
Ten column diagrams, representing distributions of measures of cycle duration for the ten price cycles between 1890 and 1925, are shown in Figure 77. Because of the limited number of cases in each period the distributions relating to individual cycles lack the regularity of the distribution made up of entries for all cycles. They show distinctive characteristics, however, and important differences are discernible between the distributions for different cycles. A heavy concentration of frequencies, such as is found in the distribution relating to the cycle between 1919 and 1922, represents a fairly high degree of uniformity in cycle duration. There are few commodities that depart widely from the average for this cycle. Quite different are the distributions representing the four cycles occurring between 1895 and 1908. These four vary somewhat in type, but they are alike in that they reflect wide dissimilarities between commodities in respect to the duration of price cycles.

Differences between the distributions for the different cycles are not restricted to differences in degree of concentration. The

FIGURE 76

DURATION OF CYCLES IN COMMODITY PRICES.

Column Diagram Showing the Distribution of 1110 Observations on Individual Commodity Price Series.



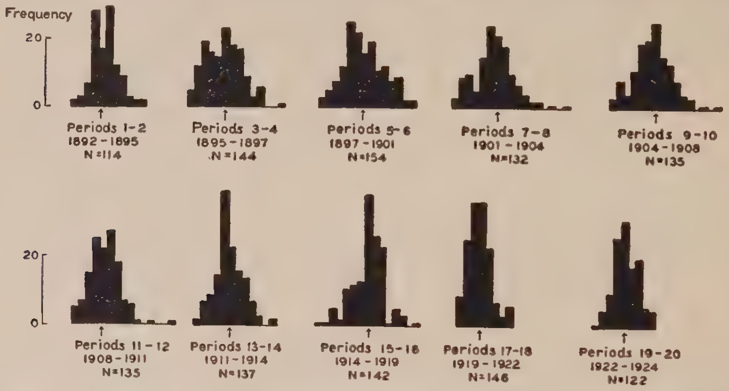
fairly symmetrical distributions relating to the cycles which occurred between 1904 and 1908, and between 1911 and 1914, stand in contrast to the curious irregularities of the distribution given by the measures for the war-time cycle.

The means and standard deviations of the various distributions shown in Figure 77 are given in Table 141. For purposes of comparison, figures showing the duration of cycles in the wholesale price index of the Bureau of Labor Statistics (supplemented by Falkner's index for the period 1890-99) are included in the table. The averages, and the measures descriptive of the behavior of the wholesale price index, are shown graphically in Figure 78.

FIGURE 77

DURATION OF CYCLES IN COMMODITY PRICES.

Column Diagrams of Distributions Relating to Ten Business Cycles.[1]



[1] The means and standard deviations of these distributions are given in Table 141. The location of the mean on the x-axis of each diagram is indicated by an arrow. The class interval is 5 months, centering at 10, 15, etc.

There are differences in detail between the averages shown in the upper part of Figure 78 and the measures of cycle duration

TABLE 141

DURATION OF CYCLES IN COMMODITY PRICES

Averages and Measures of Variation derived from Observations on Individual Commodities, with Measures relating to an Index of Wholesale Prices

(1) Terminal dates of cycle[1]	(2) No. of observations[2]	(3) Mean duration of cycle (from low to low) in months	(4) Standard deviation, in months	(5) Coefficient of variation	(6) Duration of cycle in wholesale price index, in months
1892 to 1895	114	32.3	9.4	29.2	34
1895 to 1897	144	33.3	13.0	38.8	26
1897 to 1901	154	45.1	14.3	31.8	50
1901 to 1904	132	42.7	12.8	30.0	36
1904 to 1908	135	47.9	13.3	27.8	43
1908 to 1911	135	36.4	10.8	29.8	40
1911 to 1914	137	38.4	10.3	26.8	41
1914 to 1919	142	50.0	11.1	22.3	51
1919 to 1922	146	33.4	8.0	24.1	35
1922 to 1924	122	31.1	8.3	26.8	29
Selected series, all periods[3]	1110	39.2	12.9	33.0	

[1] The terminal years given are those in which fall the reference dates for successive periods of revival. The dates upon which the measures of duration for individual commodities are based may, of course, fall beyond the terminal dates here given.

[2] The number of cases here listed is in all cases smaller than the proportion given in column (2) of Table 126. In preparing Table 126 a commodity was classed as passing through a complete cycle if a revival and a succeeding recession were recorded. In measuring duration of cycle, however, it was necessary that a specific date for the next revival should be available.

[3] See note 2, Table 130, concerning the selected series.

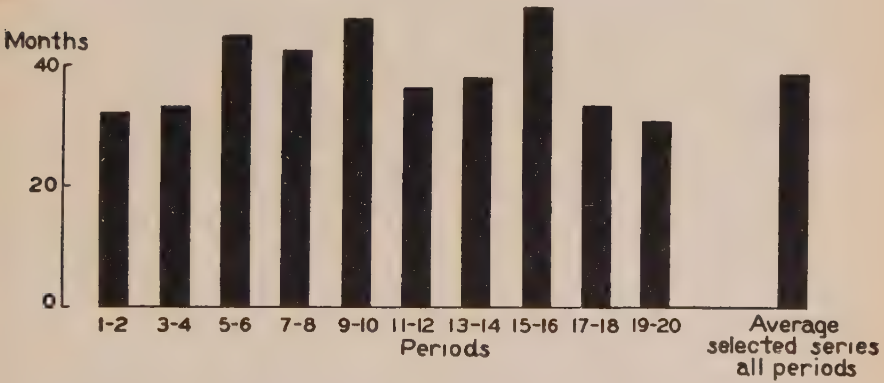
derived from the wholesale price index, which are plotted in the lower half of the chart. In computing each average only those commodities have been included which passed through a complete cycle, from low to low. This accounts, in part, for the differences. Again, there are offsetting movements in the individual price changes which affect the dates of high and low recorded by the general index. These do not affect the averages, as each commodity is treated as a unit in determining the length of its price cycle.

FIGURE 78

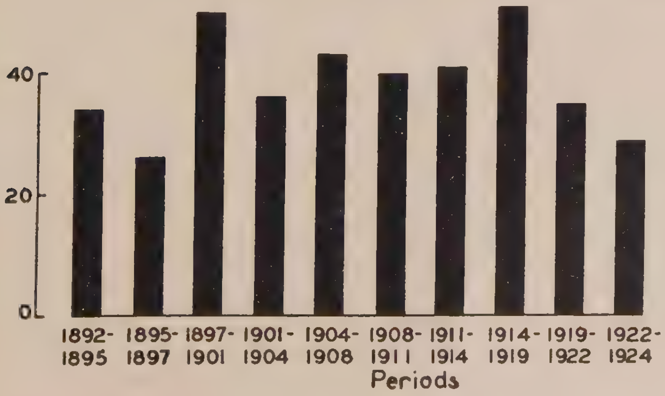
Duration of Cycles in Commodity Prices.

Comparison of Averages Computed from Individual Observations with Measures Derived from the Index of Wholesale Prices of the United States Bureau of Labor Statistics.

Averages Computed from Individual Observations



Measures Derived from the Index of Wholesale Prices of the United States Bureau of Labor Statistics



In showing that the duration of complete cyclical movements varies from cycle to cycle, the above records merely substantiate other evidence on this point. Of greater interest, perhaps, are the measures of variation for the individual cycles, which are given in columns (4) and (5) of Table 141. These indicate the degree to which the individual commodity price series depart from uniformity in respect to the duration of the cycles recorded. The degree of variation was least, as measured in absolute units, during the cycle which extended from the low of 1919 to the low of 1921-22 (standard deviation 8.0 months). The variation was greatest, in absolute units, during the cycle which extended from the low of 1897 to the low of 1901 (standard deviation 14.3 months). The variation relative to the duration of the cycle was least for the cycle extending from 1914 to 1919 (coefficient of variation 22.3) and greatest for the cycle extending from 1895 to 1897 (coefficient of variation 38.8). These measures represent considerable departures from uniformity. Not only does the duration of the price cycle vary from cycle to cycle, but within each cycle there are material differences between individual commodities in duration of cyclical swings.

e. *The Amplitude of Cycles in Commodity Prices.* One of the measures of price behavior which was explained in Chapter I was an index of cyclical variability, a measure of the amplitude of cyclical swings in the prices of individual commodities.[1] In the following table a number of such indexes, relating to the behavior of 149 price series during the period between 1890 and 1925, are combined in a frequency distribution. The distribution is shown graphically in Figure 79.

This distribution of measures of cyclical variability shows the positive skewness characteristic of price distributions. The value of the crude mode is 21.5. (This may be interpreted as a percentage, if it be remembered that the base of the percentage is the high value in each cycle.) The mean is 30.8 and the standard deviation 15.5. The coefficient of variation, 50.3, is considerably higher than the corresponding measure of 33.0, for the measures of cycle duration. (The coefficient of variation relating to amplitude of cyclical fluctuations would still be higher than that relating to cycle duration, though by a smaller margin, if the percentages measuring cyclical variability were based upon the mean price in each cycle, instead of the high value.) These relative measures of variability indicate that prices differ among themselves in respect

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[1] See pp. 85-86 for an explanation of this index.

TABLE 142

AMPLITUDE OF CYCLES IN COMMODITY PRICES

Frequency Table Showing the Distribution of 1110 Observations on 149 Commodity Price Series during Ten Business Cycles

Amplitude of cycle (as measured by the index of cyclical variability)	Frequency
.50 to 6.49	27
6.50 to 12.49	92
12.50 to 18.49	148
18.50 to 24.49	181
24.50 to 30.49	145
30.50 to 36.49	134
36.50 to 42.49	133
42.50 to 48.49	80
48.50 to 54.49	79
54.50 to 60.49	48
60.50 to 66.49	30
66.50 to 72.49	6
72.50 to 78.49	4
78.50 to 84.49	3
Total	1110

to the amplitude of their cyclical swings more than they do in respect to the duration of these movements.

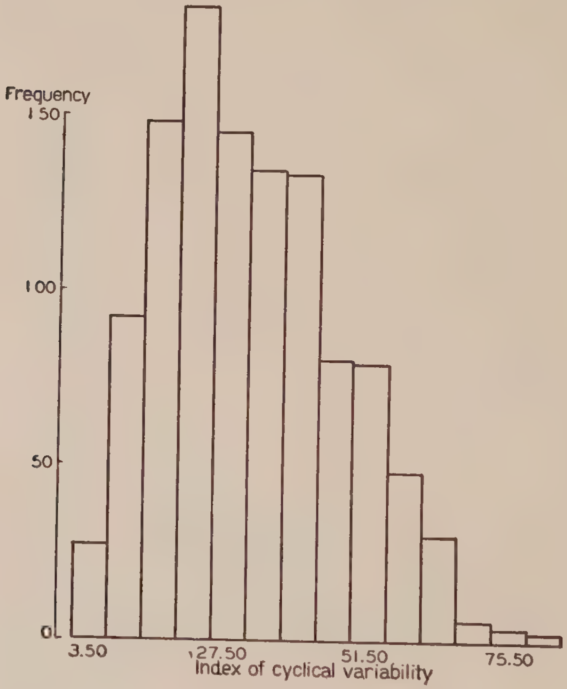
When we combine the indexes of cyclical variability relating to individual cycles, the distributions represented in Figure 80 are secured. Although there are some differences from cycle to cycle, the type represented by the general distribution is approximated by most of these distributions for specific cycles. The presence of a small group of highly variable commodities introduces a fairly consistent tendency toward positive skewness. There is a concentration of cases near the lower end of the scale, with a tail extending to the right. It is worthy of note that the two distributions which depart most widely from the type of the general distribution shown in Figure 79 are those relating to the cycles which occurred between 1914 and 1919, and between 1919 and 1922. These are much more symmetrical than any of the others. These are, of course, the cycles during which the amplitude of price fluctuations was greatest. When nearly all commodities change materially in price, the commodities which are normally more variable in price than the rest do not stand out as an exceptional group.

For effective comparison the means and measures of variation

FIGURE 79

Amplitude of Cycles in Commodity Prices.

Column Diagram Showing the Distribution of 1110 Observations on Individual Commodity Price Series.



of these individual distributions are needed. These are summarized in the following table, together with indexes of cyclical variability derived from the wholesale price index of the Bureau of Labor Statistics (supplemented by Falkner's index for the period prior to 1900). The averages and the measures derived from the wholesale price index are shown graphically in Figure 81.

For two cycles, that extending from the low of 1914 to the low of 1919 and that extending from the low of 1919 to the low of 1921-22, the average of the indexes of variability exceeds 45. The maximum value is 48.5, recorded in the cycle during which war-time expansion occurred. For all other cycles the averages vary between 25 and 32. The approximate uniformity of these averages, except for the two cycles mentioned, is noteworthy. In the usual cycle, which is not complicated by the effects of such extreme inflation and deflation as marked the years between 1915 and 1921, the average range of price fluctuations for those commodities which share

TABLE 143

Amplitude of Cycles in Commodity Prices

Averages and Measures of Variation derived from Observations on Individual Commodities, with Measures relating to an Index of Wholesale Prices

(1) Terminal dates of cycle[1]	(2) No. of observations[2]	(3) Mean	(4) Standard deviation	(5) Coefficient of variation	(6) Amplitude of cycles in wholesale price index
1892–1895	120	25.6	13.0	50.8	8.0
1895–1897	145	26.6	13.9	52.2	4.6
1897–1901	161	31.4	14.1	45.1	12.4
1901–1904	135	29.6	15.5	52.3	11.0
1904–1908	140	30.7	13.8	44.8	10.4
1908–1911	138	27.0	16.0	59.3	15.2
1911–1914	137	25.4	13.1	51.6	8.1
1914–1919	142	48.5	13.8	28.5	28.8
1919–1922	147	45.2	14.7	32.5	32.7
1922–1924	129	28.6	15.5	54.1	10.9
Selected series, all periods[3]	1110	30.8	15.5	50.3	

[1] The terminal years given are those in which fall the reference dates for successive periods of revival. The dates of the turns upon which the measures of cyclical variability for individual commodities are based may fall beyond the terminal dates here given.

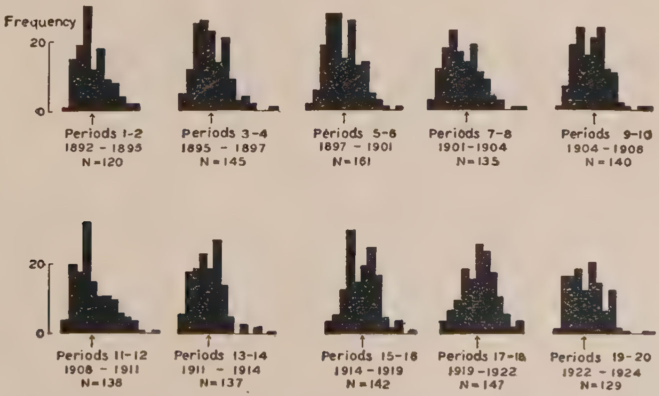
[2] The number of cases here listed is for most cycles slightly greater than the corresponding number in Table 141. In certain cases (as when a commodity failed to rise in price at the end of a given cycle but remained constant in price for one or more cyclical phases thereafter) it was possible to measure the amplitude of the cyclical swing, but not the duration.

[3] See note 2, Table 130, concerning the selected series.

FIGURE 80

Amplitude of Cycles in Commodity Prices.

Column Diagrams of Distributions Relating to Ten Business Cycles.[1]



[1] The means and standard deviations of these distributions are given in Table 143. The location of the mean on the x-axis of each diagram is indicated by an arrow. The class interval is 6 (in units of the index of cyclical variability), centering at 2.5, 8.5, etc.

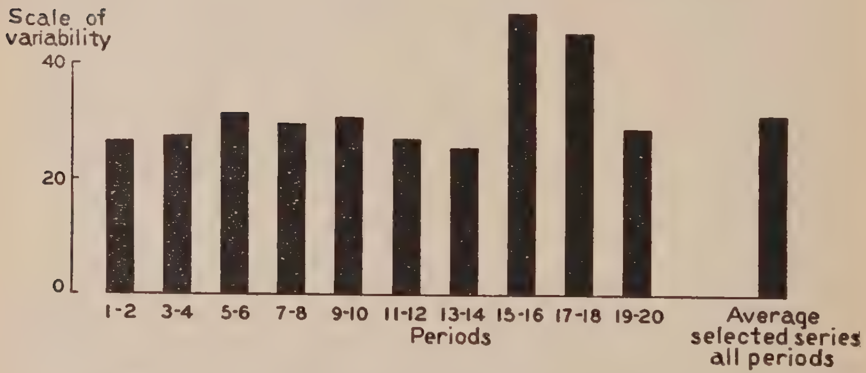
in the cycle amounts to from 25 per cent to 32 per cent of the high value or, approximately, from 29 per cent to 38 per cent of the average value.

FIGURE 81

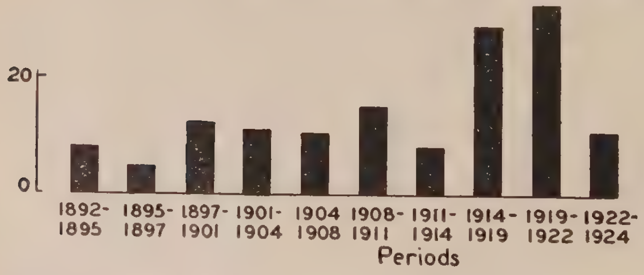
Amplitude of Cycles in Commodity Prices.

Comparison of Averages Computed from Individual Observations with Measures Derived from the Index of Wholesale Prices of the United States Bureau of Labor Statistics.

Averages Computed from Individual Observations



Measures Derived from the Index of Wholesale Prices of the United States Bureau of Labor Statistics



Within each cycle the individual commodities vary from the average, however. The standard deviation ranges from 13 to 16, averaging about 15, or 50 per cent of the mean. The measure of average amplitude represents, of course, only a central tendency. The variations both above and below this value are pronounced and important.

As might be expected, the averages of the variability measures for individual commodities are much higher than the measures of cyclical variability derived from the wholesale price index. The averages are based only upon measures for those commodities which reflected given cycles in their price movements, whereas the general index is influenced by those commodities which did not pass through the cycle, as well as by those which did. Again, the fact that all commodities do not reflect the cyclical movements of business at precisely the same time leads to some offsetting, which tends to lessen the degree of fluctuation of the general index. Only when the cyclical swings are generally reflected among commodity prices, as during the two cycles which occurred between 1914 and 1922, do the measures relating to the index approach the averages derived from individual commodities.

§ Comparison of Distribution Types

In earlier sections attention has been paid to the general characteristics of the population of commodity prices. Comparisons have been made with other populations, biological and economic, in determining the degree of stability which the population of prices appears to possess. The measures which, in combination, enable group characteristics to be studied relate in each case to a particular attribute of prices, or to a particular type of behavior. We may, in summarizing the behavior of prices during business cycles, consider the characteristics of these measures when combined as frequency distributions. Such distributions have been presented above, in following changes from cycle to cycle, but the descriptive measures have been confined to measures of central tendency and variation. These and other attributes are summarized in the table on page 432. The present analysis has been restricted to distributions of individual measures, as combined for all cycles. The measures combined in the several distributions range in number from 1110 to 1118. The observations included relate to the behavior of 149 price series during the ten cycles between 1890 and 1925.[1]

Points defined by the criteria β_1 and β_2 for these distributions are plotted in Figure 57, in an earlier section of this chapter (p. 385).

These distributions constitute the most uniform group of any so far studied. They vary somewhat among themselves, six being of Type I and two of Type IV, but the degree of variation is much less pronounced than that found among any of the other groups analyzed. It is quite probable that wider variation would be found if distributions for the separate cycles were analyzed in detail, but this has not been attempted.

Points representing two of these distributions, those relating to the timing of revival and to the timing of recession, fall fairly close to the axis of symmetry. In respect to the time of movement during major cyclical turns there is an almost symmetrical distribution about the

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[1] Commodities classed as exceptional and commodities which reflected in their price movements less than five of the ten cycles during this period have been omitted from these tabulations.

TABLE 144

Statistical Constants Relating to Distributions of Measures of Cyclical Price Behavior

(1) Cyclical movement	(2) Mean	(3) Median	(4) Standard deviation	(5) Coefficient of variation	(6) β_1	(7) β_2	(8) Skewness	(9) Kurtosis	(10) κ_1	(11) κ_2	(12) r	(13) Pearsonian curve type
Timing of revival	+2.5920	+2.2953	9.6237	[1]	.0620	3.6257	.0942	.6257	1.0654	.0446	14.4379	IV
Timing of recession	+ .9810	+ .8886	8.4453	[1]	.0144	3.8842	.0400	.8842	1.7252	.0064	9.9807	IV
Duration of rise	22.1729	19.8548	13.2570	59.8	.4198	2.8238	.7255	— .1762	—1.6118	— .2200	— 5.2264	I
Duration of fall	16.9514	16.0538	9.5835	56.5	.5049	3.6380	.3828	.6380	— .2387	—1.7872	— 53.6179	I
Duration of cycle	39.1575	38.0990	12.9220	33.0	.1950	3.2831	.2221	.2831	— .0188	—8.1582	—666.4149	I
Percentage of rise	32.7596	30.0878	19.2282	58.7	.2698	2.5346	.6997	— .4654	—1.7402	— .1273	— 4.3609	I
Percentage of fall	28.9266	26.1972	17.2806	59.7	.4507	2.9430	.6625	— .0570	—1.4661	— .2605	— 6.1072	I
Index of cyclical variability	30.8294	28.9274	15.5076	50.3	.2241	2.6511	.4595	— .3489	—1.3701	— .1315	— 6.2492	I

[1] Not significant, because of the arbitrary nature of the reference date from which deviations are measured.

mean. The other distributions are somewhat less symmetrical, but in no case do we get the extreme skewness found in the distributions of price relatives and in the distributions relating to monthly variability.

In one other respect these distributions differ significantly from most of those previously studied. Four of the eight distributions in this group are flat-topped (i. e. the measures of kurtosis are negative). In each of these four distributions (which relate to duration of rise, percentage of rise, percentage of fall and degree of cyclical variability) there is less concentration in the neighborhood of the mode than there is in a corresponding normal distribution. Most of the distributions secured by combining measures of price behavior are characteristically peaked.

As in the case of the other distributions represented by points in Figure 57, the present group contains no examples of heterotypic distributions. There is no evidence here of the presence of those presumably disruptive elements which carry a distribution into the heterotypic area. The contrast between these distributions and the distributions of fixed base and link relatives which were presented in Chapter III is apparent.[1]

III Summary

1. In investigating the behavior of prices in combination all the measures descriptive of the behavior of individual commodities have been combined in the form of frequency distributions. The third chapter dealt with price relatives in combination. Characteristics of combinations of the other measures described in earlier sections are discussed in the fourth chapter.

2. Distributions of measures of monthly price variability show a heavy concentration of frequencies at the lower end of the scale, a condition which indicates a relatively low degree of variability for the great bulk of commodities. A small number of commodities, however, are marked by extremely high price variability. The presence of these two elements—markedly stable and highly variable commodities—is reflected in many of the distributions made up of measures of price behavior, and accounts for certain important attributes of the system of prices.

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[1] It should be noted that the two sets of distributions are not fully comparable. The distributions of cyclical measures include a great many more observations, since they are drawn from all periods, and for this reason would be expected to have somewhat more stable characteristics. Again, the distributions of cyclical measures are based upon a selected list of commodities, certain ones being excluded because they are classed as exceptional, or because they did not reflect in their price movements the major cyclical swings of general business. Perhaps more important than these limitations is the fact that the rules governing the derivation of the individual cyclical measures (see pp. 76-82, 89-90) are in some respects arbitrary, whereas the price relatives are derived by a purely objective process. Finally, measures of cyclical movements have been secured only for those commodities which share in specific cycles. Those which fail to conform are of necessity excluded from the compilation, although account has been taken of them elsewhere.

3. The study of measures of monthly price variability reveals that the amplitude of the fluctuations of commodity prices, viewed collectively, does not ordinarily vary greatly from one year to the next. The host of cyclical and other factors affecting the prices of individual commodities exert a continuous influence. During the violent disturbances of the war and post-war years, however, the values of the annual averages of measures of monthly variability were materially increased.

4. During the period 1890-1913 there was a secular decline in the monthly variability of commodity prices at wholesale in the United States.

5. The distributions of measures of frequency of price change show curious concentrations at the upper and lower ends of the scale. Most commodities change in price very seldom or very frequently. A relatively small number fall in the middle ranges of the scale of frequency of change.

6. Prices of the large bulk of commodities at wholesale are affected to some extent during general business revivals and recessions. The following figures, based upon the total number of cyclical movements recorded in 209 commodity price series during ten business cycles (including 11 periods of revival and 10 of recession), indicate the degree to which general business cycles are reflected in wholesale commodity markets.[1]

Object of observation	Total number of observations on individual commodities	Number showing price turns conforming to prevailing cyclical movements	Percentage showing price turns conforming to prevailing cyclical movements
Behavior during revival	2299	1832	79.7
Behavior during recession	2090	1623	77.7
Behavior during successive phases of revival and recession	2090	1485	71.1

The number of commodities sharing in business revivals has constituted, on the average, 79.7 per cent of the commodities studied in specific cycles. This proportion has fluctuated, from cycle to cycle during the period since 1890, between 67 per cent and 95 per cent.

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[1] In securing the figures upon which these entries are based, no attempt was made to isolate cyclical movements from secular, seasonal and accidental changes. Account was taken of any distinct upward or downward price swing which appeared to be connected with prevailing cyclical movements.

The proportion affected by general price recessions has averaged 77.7 per cent, and has ranged in different cycles, between 70 per cent and 95 per cent.

The number of commodities classed as passing through a complete cycle (i. e. experiencing cyclical turns during successive phases of revival and recession) has constituted, on the average, 71.1 per cent of the commodities studied. The proportion has varied, from cycle to cycle, between 65 per cent and 78 per cent of the total.

7. Measures relating to eight aspects of price behavior during each of ten business cycles occurring between 1890 and 1925 have been combined in frequency distributions, and measures of central tendency and variation have been computed for each of these distributions. The detailed information concerning the group behavior of commodity prices during business cycles which these measures yield may not be readily summarized. A few of the points revealed by a study of these distributions are noted in the following paragraphs.

a. The majority of commodities turn upward in price during revival within a twelve-month interval which extends from 1.5 months before the date of the up-turn in the index of wholesale prices to 10.5 months after that date. The characteristics of the distributions relating to the timing of revival in the prices of individual commodities differ materially from cycle to cycle, however.

b. The period of greatest concentration during recession extends from 4.5 months before the date of the down-turn in the wholesale price index to 7.5 months after that date.

As in the case of revival, the character of the distribution of measures relating to the timing of price decline indicates that many forces are affecting prices during such a movement, and that these forces vary in intensity with the passage of time. During recession there is a steady cumulative gain in the intensity of these forces until the flood of falling prices has reached its maximum volume. Then comes a decline in intensity, a regular subsidence which is almost perfectly symmetrical with the preceding increase.

The distributions relating to different periods of recession vary materially in respect to the location of their central tendencies, and in degree of dispersion.

c. For both revival and recession the mean date of turn secured by averaging the measures relating to individual commodities comes after the date of turn in the general index of wholesale prices. The averages for all periods show a mean date of turn following the general price index by 2.6 months on revival and by 1.0 month on recession. There is an indication here that the cyclical turns in the price index are in general due to changes in the prices of a relatively small number of commodities which move in advance of the bulk of commodities at such times.

d. The degree of variation from the mean date of turn varies from cycle to cycle, in respect to both revival and recession, but the variation is in general greater during revival than during recession. The standard deviation of 1110 measures relating to the timing of price revival is 9.6 months. The corresponding measure for price recession is 8.4 months. The decline in prices which occurs in the wholesale markets of the country at a time of recession is a more concentrated and uniform movement, it appears, than is the rise of prices during revival.

e. The downward movements of commodity prices are shorter on the average, than the up-swings (17 months, as compared with 22.2 months). The recessions are also more compact, in respect to duration, than are the upward movements. The standard deviation of 1110 measures relating to duration of periods of price fall is 9.6 months, as compared with 13.3 months for the same number of measures relating to the duration of periods of price rise.

f. During the period since 1890 the average increase of commodity prices at wholesale during revival has exceeded the average decline during recession, a natural accompaniment, of course, of the upward trend of prices during this period. Expressing both increase and decrease as percentages of the high values recorded during specific cyclical movements, the most common (i. e. the modal) increase during revivals in this period was 21.5 per cent, and the most common (modal) decline was 15 per cent. (The modal increase was approximately 27 per cent of the low price in each cycle.)

The mean increase during revival, expressed as a percentage of the high value, was 32.8 per cent, and the mean decline, on the same base, was 28.9 per cent. (When the base of the percentages is the average of low and high prices in each cycle, these two means become approximately 39 per cent and 34 per cent.)

g. The average length of cycles in the prices of individual commodities at wholesale during the period since 1890 has been 39.2 months. For specific cycles the average has varied from 31.1 months to 50.0 months. Within each cycle there are material differences between individual commodities in respect to the duration of cyclical swings.

h. The average amplitude of cyclical price swings during the period since 1890 is measured by an index of 30.8. (This index is computed from percentages based upon the high values in specific cycles.) This represents a swing from low to high (and from high to low) equal to about 37 per cent of the average of low and high values. The variation from cycle to cycle in respect to the amplitude of price movements is not marked under ordinary conditions. Only during the violent disturbances between 1914 and 1922 was the amplitude of cyclical price fluctuations materially increased.

8. A detailed study of the movements of individual price series shows that the cycles which are discernible in the movements of a general price index are the net resultants of a host of widely different movements in the prices of individual commodities. The prices of some commodities do not conform to general business cycles at all. Those commodities that do reflect a general cycle in their price movements differ materially among themselves in respect to the timing of revival and recession and in the duration and amplitude of their cyclical swings. Cycles in commodity prices appear as broad tendencies among varied movements. In attempting, in this analysis, to trace and to measure some of these tendencies, they have been shown against the background of diverse and complicated price fluctuations which constitute a continuing element in the economic situation. It is an advantage, as it is also, perhaps, a defect, of this procedure that the diversities are retained, and presented in the final picture.

The immediate objectives of the present study are the development of a method of analysis and the accumulation of a body of facts which may conduce to an understanding of the price system.

This volume has dealt with the following aspects of the general problem:

1. The behavior of the prices of individual commodities, and the relations among different attributes of commodity prices.
2. Regional differences between commodity prices, and differences from market to market in the behavior of prices of individual commodities.
3. Certain problems related to the measurement of changes in the general level of wholesale prices.
4. The measurement and significance of price dispersion and of price displacement.
5. The effect of changes in the price level upon relations among the prices of individual commodities.
6. The characteristics of the population of prices, as revealed by the behavior, in combination, of price relatives and of measures of variability, trends and cyclical movements in the prices of individual commodities.

No attempt has been made, in presenting the results of this study, to support a specific thesis. The investigation has been looked upon as part of a general attack upon the problem of charting the price system, defining its elements, tracing the connections between these elements, determining the nature of the changes which occur in the price system with the passage of time and with changes in general economic conditions, and of describing more exactly the part which the system of prices plays in economic processes. This view of the relation of the present study to the broad task of surveying the price system has conditioned the plans for the investigation and has determined the form in which the results appear.

In concluding the account of the first part of this study, attention may be drawn to two significant facts. One is the existence of wide diversities in the behavior of the prices of individual commodities. This is true in respect to every type of behavior dealt with in the preceding pages. To the economist whose interest lies in changes in the purchasing power of the monetary unit such diversities present themselves as troublesome complications. For in the multiplicity of divergent fluctuations he seeks to measure a central tendency, to trace the effects of a single factor. But, as so often has been the case in the history of science, the phenomena which appear merely as irrelevant and irritating complexities to one generation of research workers become, to another generation, the means of solving old problems and of discovering new laws. There lie here, ready to the economist's hand, materials from which new knowledge may be gleaned.

The second fact of importance is the existence, among the diversity of price movements, of just those uniformities for which the scientist searches in attempting to reduce masses of facts to understandable terms. The present investigation and those which have preceded it in this field have gone only a little way in the search for principles of order among the variations within the price system, but there have been revealed numerous interrelations and uniformities, and there have been found many clues to other regularities. In the existence of these regularities lies our hope of achieving a fuller understanding of the working of the system of prices.

APPENDIX TABLES

TABLE I

DESCRIPTIONS OF WHOLESALE PRICE QUOTATIONS.[1]

(1) Ref. No.[2]	(2) Commodity	(3) Description	(4) Source of price quotation	(5) Market	(6) Derivation of published figure[3]	(7) Nature of price (or type of transaction)	(8) Weights used in the construction of index numbers and other measures	(9)
							1890–1913 or 1902–1913[4]	1913–1926
1	Barley	"By Sample" malting	Daily Trade Bulletin (Commercial) Tuesday Edition	Chicago	M W	Range of cash sales on Tuesday, Chicago Board of Trade.	20	20
2	Corn	Cash, contract grades	do	Chicago	M W	do	100	40
3	Corn	Cash, No.3, mixed	do	do	M W	do		60
4	Oats	Cash, No.2, white	do	do	M W	Range of cash sales on Tuesday, Chicago Board of Trade (Ill. Proportional Billing)	50	50
5	Rye	No. 2 cash	do	do	M W	Range of cash sales on Tuesday, Chicago Board of Trade.	30	30

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[1] This table was prepared at the request of the National Bureau of Economic Research by Mr. Charles A. Bell, chief of the division of prices of the United States Bureau of Labor Statistics. Permission to publish the table has been courteously extended by Dr. Ethelbert Stewart, Commissioner of Labor Statistics. The entries in the various columns relate to the 1926 price quotations. These descriptions apply to prices for earlier years except where grade, market or type of quotation has been changed. Major changes in these respects are indicated in the wholesale price bulletins of the Bureau of Labor Statistics.

[2] The gaps in the order of these reference numbers represent commodities excluded from the present study because the data relating to them did not cover sufficiently long periods of time.

[3] The symbols in column (6), showing the derivation of the published figures, have the following meanings:

MD: monthly average of daily quotations.
MW: monthly average of weekly quotations.
FM: first of month quotations.

[4] **Weights** relating to the period 1902-1913 only are marked by asterisks; all other weights relate to both periods (1890-1902, 1902-1913).

TABLE I (Continued)

Descriptions of Wholesale Price Quotations.

(1) Ref. No.	(2) Commodity	(3) Description	(4) Source of price quotation	(5) Market	(6) Derivation of published figure	(7) Nature of price (or type of transaction)	(8) Weights used in the construction of index numbers and other measures	(9)
							1890–1913 or 1902–1913	1913–1926
6	Wheat	No. 1, northern spring, cash	do	do	M W	do	300	40
7	Wheat	No. 2, red winter cash	do	do	M W	do		100
8	Wheat	No. 2, ordinary hard winter cash	Kansas City Star Wednesday Edition	Kansas City	M W	Range of cash sales on Tuesday.		100
9	Wheat	No. 1, northern spring cash	Daily Market Record. Tuesday Edition.	Minneapolis	M W	Range of "official closing" cash prices.		40
10	Wheat	No. 1, hard white, cash	Reported by former Federal Grain Supervisor.	Portland, Ore.	M W	Average price on Tuesday.		20
13	Cattle	Steers, choice to prime, heavy beeves, corn fed	Chicago Daily Drovers' Journal. Monday Edition.	do	M W	Price paid by slaughterer to commission man acting for producer.	150	150
14	Cattle	Steers, good to choice, corn fed	do	do	M W	do	250	250
15	Hogs	Heavy, range of fair to choice, heavy butchers	do	do	M W	do	100	100
16	Hogs	Light, range of fair to choice, light butchers	do	do	M W	do	200	200

17	Sheep	Ewes, native, all grades, fair to best, range	do	do	M W	do	10	5
18	Sheep	Lambs western range lambs, medium to good, range	do	do	M W	do		30
19	Sheep	Wethers, fed Wethers, poor to best, range	do	do	M W	do	30	5
20	Poultry	Live fowls, small hens to heavy fat assorted (general run)	Daily Trade Bulletin (Produce section) Tuesday Edition	Chicago	M W	Range of prices paid by wholesale dealer on Tuesday.		20
21	Poultry	Live fowls, medium (freight or express)	N. Y. Journal of Commerce and Commercial Bulletin. (Wednesday Edition)	New York	M W	Range of prices paid by wholesale dealer on Tuesday.		20
22	Beans	Medium, choice, Pea Bean	do	do	M W	Range of prices paid by jobber on Tuesday	20	20
23	Clover seed	Contract grades, red clover, good, spot	Seed World	Chicago	M D	Daily quotations on wholesale market.		3
24	Cotton	Middling, spot price	Times Picayune (Wednesday Edition)	New Orleans	M W	Closing quotation on New Orleans Cotton exchange (Tuesday)		250
25	Cotton	Middling, upland, spot price	N. Y. Journal of Commerce and Commercial Bulletin (Wednesday Edition)	New York	M W	Closing quotation on N. Y. Cotton Exchange (Tuesday).	400	150
26	Cottonseed	Basic prime	U. S. Dept. of Agriculture	Average price at gin in producing area	15th. of month.	Price paid to producer at gin.		50
27	Eggs	Firsts, western	Weekly Market Report of the Boston Chamber of Commerce	Boston	M W	Price paid by wholesale dealer.		10

TABLE I (Continued)

DESCRIPTIONS OF WHOLESALE PRICE QUOTATIONS.

(1) Ref. No.	(2) Commodity	(3) Description	(4) Source of price quotation	(5) Market	(6) Derivation of published figure	(7) Nature of price (or type of transaction)	(i8) Weghts used in the construction of index numbers and other measures	(9)
							1890–1913 or 1902–1913	1913–1926
28	Eggs	Firsts, fresh, spot market (Monday quotation)	Chicago Dairy Produce	Chicago	M W	Range of price paid by wholesaler on Chicago Mercantile Exchange.		30
29	Eggs	Extra firsts, fresh gathered, loss off	Cincinnati Chamber of Commerce	Cincinnati	M W	Range of prices paid by wholesale dealer on Tuesday.		3
30	Eggs	Candled, Louisiana, at the mark	Times Picayune. (Wednesday Edition)	New Orleans	M W	Range of jobbers' prices to retailers on Tuesday.		2
31	Eggs	Firsts, fresh gathered	N. Y. Journal of Commerce and Commercial Bulletin (Wednesday Edition)	New York	M W	Range of prices paid by wholesale dealer on Tuesday.	100	40
32	Eggs	Extra firsts, western	Commercial List and Maritime Register	Philadelphia	M W	Range of prices paid by wholesaler on Produce Exchange on Friday.		10
33	Eggs	Fresh, selected pullets	Pacific Dairy Review	San Francisco	M W	Closing price on Wholesale Dairy Produce Exchange on Thursday.		5

34	Flaxseed	No. 1	Daily Market Record (Tuesday Edition)	Minneapolis	M W	Range of "official closing" cash price.	20	20
35	Hay	Alfalfa, No. 1	Price Current-Grain Reporter	Kansas City	M W	Range of prices in wholesale market on Saturday.		50
36	Hay	Clover mixed, No. 1	do	Cincinnati	M W	Range of prices in wholesale market on Tuesday.		20
37	Hay	Timothy, No. 1	do	Chicago	M W	Range of prices in wholesale market on Monday.		30
38	Hides	Country, calfskins, No. 1, 8 to 15 pounds	Shoe and Leather Reporter	do	M W	Range of prices to tanners in car lots on Wednesday.	100	10
40	Hides	Goatskins, Brazilian, dry weight, first selection	do	New York	M W	Range of importers prices at New York on Wednesday		40
41	Hides	Green, salted, heavy; country cows, No. 1, 60 pounds and up	do	Chicago	M W	Range of price to tanners in car lots on Wednesday		10
42	Hides	Green, salted, packers'; heavy native steers.	do	do	M W	do	100	20
43	Hides	Green, salted, packers'; heavy Texas steers	do	do	M W	do		20
44	Hops	Prime to choice, New York State	N. Y. Journal of Commerce and Commercial Bulletin (Wednesday Edition)	New York	M W	Range of prices paid by brewers on Tuesday	5	1
45	Hops	Prime to choice, Pacific Coast	Morning Oregonian (Wednesday Edition)	Portland, Ore.	M W	Range of prices paid by brewers on Tuesday		1
46	Milk	Fresh, 3.5 per cent milk	Milk News	Chicago	M D	Price per quart (computed from 8-gallon can) delivered on Chicago platform		60

TABLE I (Continued)

DESCRIPTIONS OF WHOLESALE PRICE QUOTATIONS.

(1) Ref. No.	(2) Commodity	(3) Description	(4) Source of price quotation	(5) Market	(6) Derivation of published figure	(7) Nature of price (or type of transaction)	(8) Weights used in the construction of index numbers and other measures	(9)
							1890–1913 or 1902–1913	1913–1926
47	Milk	Fresh, 3.7 per cent milk	Dairymen's League Cooperative Asso.	New York	M D	Price per quart (computed from 40-quart can) delivered in N. Y. from 150-160 mile zone	180	100
48	Milk	Fresh, 3.6 per cent milk	State Dairy Supervisor	San Francisco	M D	Price per quart (computed from gallon price) delivered in San Francisco		20
49	Onions	Fresh, yellow varieties (or yellow and red)	Daily Trade Bulletin (Produce section) Tuesday Edition	Chicago	M W	Range of prices paid by wholesale dealer on Tuesday	5	5
50	Peanuts	No. 1 grade	Virginian Pilot (Wednesday Edition)	Norfolk, Va.	M W	Range of wholesale prices on Tuesday		10
51	Potatoes	White, good to choice, bulk	Daily Trade Bulletin (Produce section) Tuesday Edition	Chicago	M W	Range of prices paid by wholesaler on Tuesday	50	50
52	Potatoes	Sweet, Jersey, No. 1, per 5/8 bushel basket	Commercial List & Maritime Register	Philadelphia	M W	Range of prices paid by wholesaler on Produce Exchange on Friday		5

53	Rice	Honduras, head, clean, medium to choice	Times Picayune (Wednesday Edition)	New Orleans	M W	Range of prices from mills to jobbers on Tuesday	20	20
54	Tobacco	Leaf, average warehouse sales	State Commissioner of Agriculture	Kentucky	M D	Average warehouse price in State of Kentucky		130
55	Tobacco	Burley, dark red, good leaf	Western Tobacco Journal	Louisville	M W	Range of Official quotations on Louisville Tobacco Exchange on Saturday		
56	Wool	Domestic, Ohio, grease basis, fine clothing (formerly reduced to scoured basis.)	"Jobber"	Boston	M D	Average jobber's price to manufacturer	80	60
57	Wool	Domestic, Ohio, grease, basis, fine delaine (Formerly reduced to scoured basis)	do	do	M D	do		20
58	Wool	Domestic, Ohio, grease basis, half-blood (Formerly reduced, to scoured basis)	do	do	M D	do		20
59	Wool	Domestic, Ohio, medium (¼ and ⅜ grades) grease basis (formerly reduced to scoured basis)	do	do	M D	do	40	20
60	Beef	Fresh, carcass, good native steers	National Provisioner	Chicago	M W	Range of prices paid by jobber to slaughterer on Friday		130
61	Beef	Fresh, steer, loins, ends, hips	do	do	M W	Range of wholesale price on Friday		
62	Beef	Fresh, steer, ribs, No. 2	do	do	M W	do		
63	Beef	Fresh, steer, rounds, No. 2	do	do	M W	do		

TABLE I (Continued)

DESCRIPTIONS OF WHOLESALE PRICE QUOTATIONS.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ref. No.	Commodity	Description	Source of price quotation	Market	Derivation of published figure	Nature of price (or type of transaction)	Weights used in the construction of index numbers and other measures	
							1890–1913 or 1902–1913	1913–1926
64	Beef	Fresh, native sides	N. Y. Journal of Commerce and Commercial Bulletin (Wednesday Edition)	New York	M W	Range of price paid by jobber to slaughterer on Tuesday	250	120
65	Beef	Fresh, loins, No. 2, city	National Provisioner	do	M W	Range of wholesale price on Friday		
66	Beef	Fresh, ribs, No. 2, city	do	do	M W	do		
67	Beef	Fresh, rounds, No. 2, city	do	do	M W	do		
68	Beef	Salt, extra mess	New York Produce Exchange	do	M W	Range of price paid to packer by exporter on Tuesday	5	5
69	Hams	Smoked, loose	Daily Trade Bulletin (Commercial section) Tuesday Edition.	Chicago	M W	Range of packers' price on Tuesday	100	100
70	Lamb	Dressed, medium	National Provisioner	do	M W	Range of price paid by jobber to slaughterer on Friday		25
71	Mutton	Dressed	N. Y. Journal of Commerce and Commercial Bulletin (Wednesday Edition)	New York	M W	Range of price paid by jobber to slaughterer on Tuesday	10	10

72	Pork	Fresh, loins, 8 to 10 pounds average	National Provisioner	Chicago	M W	Range of wholesale price on Friday		30
73	Pork	Fresh, loins, western, 10 to 12 pounds average	do	New York	M W	do		30
74	Pork	Cured, salt, mess	New York Produce Exchange	do	M W	Range of price paid to packer by exporter on Tuesday	60	60
75	Pork	Cured, rough sides	Daily Trade Bulletin (Commercial section) Tuesday Edition.	Chicago	M W	Range of packers' price on Tuesday	30	30
76	Pork	Cured, short clear sides	do	do	M W	do	30	30
77	Poultry	Dressed fowls, iced, scalded fowls, heavy hens	Daily Trade Bulletin (Produce section) Tuesday Edition	do	M W	Range of wholesalers' price on Tuesday		20
78	Poultry	Dressed fowls, western dry packed 12 to box, 48-54 pounds to doz., corn fed	N. Y. Journal of Commerce and Commercial Bulletin (Wednesday Edition)	New York	M W	do		25
79	Veal	Fresh, good, hide on	National Provisioner	Chicago	M W	Range of wholesale price on Thursday		40
80	Butter	Creamery, extra	Weekly Market Report of Boston Chamber of Commerce	Boston	M W	Range of prices paid by wholesale dealers on Wednesday		5
81	Butter	Creamery, firsts	do	do	M W	do		15
82	Butter	Creamery, seconds	Weekly Market Report of Boston Chamber of Commerce	Boston	M W	Range of prices paid by wholesale dealers on Wednesday		2
83	Butter	Creamery, extra, spot market	Chicago Dairy Produce	Chicago	M W	Range of prices paid by wholesaler on Chicago Mercantile Exchange on Monday		10

TABLE I (Continued)

DESCRIPTIONS OF WHOLESALE PRICE QUOTATIONS.

(1) Ref. No.	(2) Commodity	(3) Description	(4) Source of price quotation	(5) Market	(6) Derivation of published figure	(7) Nature of price (or type of transaction)	(8) Weights used in the construction of index numbers and other measures	(9)
							1890–1913 or 1902–1913	1913–1926
84	Butter	Creamery, extra firsts spot market, 91 score	do	do	M W	Range of prices paid by wholesaler on Chicago Mercantile Exchange on Saturday		40
85	Butter	Creamery firsts spot market	do	do	M W	do		5
86	Butter	Creamery as to score	Cincinnati Chamber of Commerce	Cincinnati	M W	Range of prices paid by wholesale dealer on Tuesday		3
87	Butter	Creamery, fancy	Times Picayune (Wednesday Edition)	New Orleans	M W	Range of prices paid to jobbers by retailers on Tuesday		2
88	Butter	Creamery, choice	do	do	M W	do		5
89	Butter	Creamery, extra, 92 score	N. Y. Journal of Commerce and Commercial Bulletin (Wednesday edition)	New York	M W	Range of prices paid by wholesale dealer on Tuesday	60	10
90	Butter	Creamery, firsts, 88 to 91 score	do	do	M W	do	40	30
91	Butter	Creamery, seconds, 84 to 87 score	do	do	M W	do		5

92	Butter	Creamery, extra, 92 score	Commercial List and Maritime Register	Philadelphia	M W	Range of prices paid by wholesaler on Produce Exchange on Friday		4
93	Butter	Creamery, extra firsts, 91 score	do	do	M W	do		10
94	Butter	Creamery, firsts, 88 to 90 score	do	do	M W	do		1
95	Butter	Creamery, extra	St. Louis Globe Democrat Saturday Edition	St. Louis	M W	Range of prices paid by wholesale dealer on Friday	60	5
96	Butter	Creamery, extra	Pacific Dairy Review	San Francisco	M W	Closing price on wholesale Dairy Produce Exchange on Thursday		3
97	Butter	Creamery, firsts	do	do	M W	do		5
98	Cheese	Whole milk, American twins	Daily Trade Bulletin (Produce section) Tuesday Edition.	Chicago	M W	Range of prices paid by wholesale dealer on Tuesday		20
99	Cheese	Whole milk, flats colored, average	N. Y. Journal of Commerce and Commercial Bulletin (Wednesday Edition)	New York	M W	Range of prices paid by wholesale dealer on Tuesday	30	6
100	Cheese	California flats, fancy	Pacific Dairy Review	San Francisco	M W	Closing price on wholesale Dairy Produce Exchange on Thursday		4
101	Milk	Condensed, sweetened in case of 48 14-Oz tins	N. Y. Journal of Commerce and Commercial Bulletin (Wednesday Edition)	New York	M W	Range of wholesale price to jobbers on Tuesday		30
102	Milk	Evaporated, in case of 48 16-oz tins	do	do	M W	do		40
103	Bread	Loaf, pound, before baking	Baker	Chicago	15th. of month	Bakers' price to retailer		60
104	Bread	Loaf, pound, before baking	do	Cincinnati	do	do	80	10

TABLE I (Continued)

Descriptions of Wholesale Price Quotations.

(1) Ref. No.	(2) Commodity	(3) Description	(4) Source of price quotation	(5) Market	(6) Derivation of published figure	(7) Nature of price (or type of transaction)	(8) Weights used in the construction of index numbers and other measures	(9)
							1890–1913 or 1902–1913	1913–1926
105	Bread	Loaf, pound, before baking	do	New Orleans	do	do		5
106	Bread	Loaf, pound, before baking	Baker	New York	15th. of month.	Bakers' price to retailer	120	110
107	Bread	Loaf, pound, before baking	do	San Francisco	15th. of month.	do		10
108	Cocoa beans	Arriba, Range of Seasons and Red Summer	N. Y. Journal of Commerce and Commercial Bulletin (Wednesday Edition)	New York	M W	Range of prices paid to importers by manufacturers on Tuesday		10
109	Coffee	Rio, No. 7, invoice lots, Brazil grades	do	do	M W	Range of prices paid to importers by jobbers and roasters on Tuesday	40	40
110	Copra	In bags, South Sea, sun dried	Oil, Paint and Drug Reporter.	do	M W	Importers' price on Saturday		3
111	Crackers	Oyster, dot	Jobber	do	F M	Jobbers' price		
112	Crackers	Soda, plain	do	do	F M	do		
113	Cod	Large shore (pickled, cured)	Fishery Company	Gloucester	F M	Price to wholesaler or jobber	3	3
114	Herring	Newfoundland, split, large, No. 1		New York		Dropped from compilation since 1924	1	1

115	Mackerel	Salt, large, No. 3s	Fishery Company	Boston	F M	Price to wholesaler	1	1
116	Salmon	Canned, Alaska, red, No. 1 talls	N. Y. Journal of Commerce and Comcial Bulletin (Wednesday Edition)	Cannery	M W	Range of canner's price to jobber on Tuesday	20	20
117	Flour	Rye, white	Northwestern Miller	Minneapolis	M W	Range of millers' net price to jobber in car lots on Tuesday	5	5
118	Flour	Wheat, winter patents, hard	do	Kansas City	M W	Range of millers' net price to jobber in car lots—cotton or jute bags—on Saturday FOB K. C.		80
119	Flour	Wheat, winter straights, hard	do	do	M W	do	100	20
120	Flour	Wheat, standard patents	Northwestern Miller	Minneapolis	M W	Range of miller's net price to jobbers in car lots, 98lb. cotton sacks, on Tuesday. FOB Minn.	200	100
121	Flour	Wheat, second patent	do	do	M W	do		30
122	Flour	Wheat, patents	Miller	Portland, Ore.	M D	Millers' net price to car lot buyers in 98lb. sacks		30
123	Flour	Wheat, soft patents	Northwestern Miller	St. Louis	M W	Range of millers' net price to jobber in car lots—cotton or jute bags—on Saturday		20
124	Flour	Wheat, straights, from soft wheat	do	do	M W	do		10
125	Flour	Wheat, patent from soft winter wheat	do	Toledo	M W	do		10
126	Fruit	Canned, peaches, standard, 2½ California	N. Y. Journal of Commerce and Commercial Bulletin (Wednesday Edition)	Cannery	M W	Range of canners' price to jobber on Tuesday		10

TABLE I (Continued)

DESCRIPTIONS OF WHOLESALE PRICE QUOTATIONS.

(1) Ref. No.	(2) Commodity	(3) Description	(4) Source of price quotation	(5) Market	(6) Derivation of published figure	(7) Nature of price (or type of transaction)	(8) Weights used in the construction of index numbers and other measures	(9)
							1890–1913 or 1902–1913	1913–1926
127	Fruit	Canned pineapples, Hawaiian sliced, standard, 2½	do	New York	M W	Range of wholesale price on Tuesday		10
128	Apples	Evaporated, choice, domestic dried, state, in boxes	N. Y. Journal of Commerce and Commercial Bulletin (Wednesday Edition)	New York	M W	Range of price to jobbers on Tuesday	2	2
129	Currants	Cleaned, Patras, 10 pound boxes	do	do	M W	do	1	1
130	Prunes	California in boxes, 60-70s. in 25 pound boxes	do	do	M W	do	10	10
131	Raisins	California, coast, seeded in bulk, boxes	do	do	M W	do	10	10
132	Apples	Baldwin, fresh	Daily Trade Bulletin (Produce section) Tuesday Edition	Chicago	M W	Range of prices paid by wholesale dealer on Tuesday		50
133	Bananas	Jamaica 9s, ex. dock	N. Y. Journal of Commerce and Commercial Bulletin (Wednesday Edition)	New York	M W	Range of price to jobbers on Tuesday		30

134	Lemons	California, choice or fancy	Daily Trade Bulletin (Produce Section) Tuesday Edition	Chicago	M W	Range of prices paid by wholesale dealer on Tuesday		10
135	Oranges	California, Navels and Valencias, choice 126-200 count	do	do	M W	do		40
136	Glucose	42 degree mixing	N. Y. Journal of Commerce and Commercial Bulletin (Wednesday Edition)	New York	M W	Price made by producer to manufacturer on Tuesday	10*	10
137	Hominy grits	White	Miller	FOB Mill	M W	Millers' price to dealers on Tuesday		2
138	Lard	Prime contract	New York Produce Exchange	New York	M W	Range of price on produce exchange on Tuesday	50	50
139	Meal	Corn, fine white, f. o. b. mill	Miller	FOB Mill	M W	Millers' price to dealers on Tuesday	10	10
140	Meal	Corn, yellow table, granulated, fancy	Commercial List and Maritime Register	Philadelphia	M W	Range of price paid by wholesaler on Produce Exchange on Friday	10	10
141	Molasses	New Orleans, fancy	N. Y. Journal of Commerce and Commercial Bulletin (Wednesday Edition)	New York	M W	Price to manufacturer by distributor and baker on Tuesday	10	10
142	Oatmeal	Car load lots, delivered in 90 pound sacks, spot	do	do	M W	Range of millers' price to jobber on Tuesday		10
143	Oleomargarine	Standard, uncolored, 1-lb cartons	National Provisioner	Chicago	M W	Net wholesale price in Chicago on Friday		20
144	Oleo oil	Extra	do	do	M W	Producers price to manufacturer—range		5
145	Pepper	Black, Lampong	N. Y. Journal of Commerce and Commercial Bulletin	New York	M W	Importers' price to jobber and manufacturer Range	1	1

TABLE I (Continued)

DESCRIPTIONS OF WHOLESALE PRICE QUOTATIONS.

(1) Ref. No.	(2) Commodity	(3) Description	(4) Source of price quotation	(5) Market	(6) Derivation of published figure	(7) Nature of price (or type of transaction)	(8) Weights used in the construction of index numbers and other measures 1890–1913 or 1902–1913	(9) 1913–1926
146	Salt	American, 4 medium	Manufacturer	Chicago	F M	Manufacturers' price to wholesaler	40	40
148	Starch	Corn, sunbeam, 48 1-lb packages	Jobber	New York	F M	Jobber's price		
149	Sugar	Raw, 96 degree centrifugal	Weekly Statistical Sugar Trade Journal	do	M W	Importers' price to refiner on Thursday	100	100
150	Sugar	Granulated, in barrels	do	do	M W	Refiners' price to jobber on Thursday	150	150
151	Tallow	Edible, under 2 per cent acid, 45 titre	National Provisioner	Chicago	M W	Producers' price to jobber on Friday		1
152	Tea	Formosa, fine	N. Y. Journal of Commerce and Commercial Bulletin (Wednesday Edition)	New York	M W	Range of importers' price to jobber on Tuesday	10	10
153	Corn	Canned, No. 2, Maryland standard	N. Y. Journal of Commerce and Commercial Bulletin (Wednesday Edition)	Cannery	M W	Canners' price to jobber on Tuesday		10
154	Peas	Canned, Western, No. 5, sieve, fancy, sweets	do	do	M W	do		10

155	Tomatoes	Canned, standard New Jersey No. 3	Jobber	New York	F M	Jobbers' price		10
156	Cocoanut Oil	Crude, spot, barrels, Cochin grade	Oil, Paint and Drug Reporter	New York	M W	Importers' price to manufacturer on Saturday		10
157	Corn Oil	Crude; in barrels	do	do	M W	Producers' price to manufacturer on Saturday		3
158	Cottonseed Oil	Summer yellow, prime	New York Produce Exchange	New York	M W	Range of price on N. Y. Produce Exchange on Tuesday	40	40
159	Olive Oil	Edible in barrels	Drug and Chemical Markets	New York	M W	Importers' price to distributor on Wednesday		5
160	Soya Bean Oil	Crude, in barrels	do	do	M W	Jobbers' price on Wednesday		3
161	Vinegar	Cider, domestic, 40 grain	Jobber	New York	F M	Jobbers' price	10	10
162	Boots and shoes	Children's, gun metal, polish, highcut, with rubber heel	Manufacturer	Factory (New England)	M D	Manufacturers' price to trade		10
163	Boots and shoes	Little boys,' Gun metal, blucher–whole quarter, size 8 to 13½	do	do	M D	do		10
164	Boots and shoes	Misses,' black, vici, polish, high-cut, with rubber heel	do	do	M D	do		10
165	Boots and shoes	Youths', gun metal, blucher, sizes 1 to 2	do	do	M D	do		10
166	Boots and shoes	Men's, black, calf, Goodyear welt, blucher, single, sole, solid leather	do	do	F M	do	60	20
167	Boots and shoes	Men's, black, calf, Goodyear welt, bal. whole quarter	do	Factory (Middle west)	M D	Manufacturers' price to retailer		20
168	Boots and shoes	Men's, black, dress, Goodyear welt, side leather	do	do	M D	do		10

TABLE I (Continued)

DESCRIPTIONS OF WHOLESALE PRICE QUOTATIONS.

(1) Ref. No.	(2) Commodity	(3) Description	(4) Source of price quotation	(5) Market	(6) Derivation of published figure	(7) Nature of price (or type of transaction)	(8) Weights used in the construction of index numbers and other measures	(9)
							1890–1913 or 1902–1913	1913–1926
169	Boots and shoes	Men's, gun metal, Goodyear welt, blucher, cap toe, single sole mat calf top	do	do	M D	do		20
170	Boots and shoes	Men's, mahogany, chrome, side, Goodyear welt, bal. single sole, 1-in rubber tap heel	do	do	M D	do		10
171	Boots and shoes	Men's, tan, dress, Goodyear welt, calf	do	do	M D	do		20
172	Boots and shoes	Men's, tan, dress, Goodyear welt, side leather	Manufacturer	Factory (Middle West)	M D	Manufacturers' price to retailer		10
173	Boots and shoes	Mens, chocolate elk, blucher, ½ double sole, sole leather inner sole standard screw fastened	do	Factory (New England)	F M	Manufacturers' price to jobber	25	5
174	Boots and shoes	Men's, black, vici kid Goodyear welt	do	do	F M	Manufacturers' price to trade	50	20
175	Boots and shoes	Women's, black, kid lace, Goodyear welt, 7½ in. boot	do	Factory (Middle West)	M D	Manufacturers' price to retailer		30

176	Boots and shoes	Women's, colored, calf, Goodyear welt, lace oxford, single sole, leather heel	do	do	M D	do		30
177	Boots and shoes	Women's, McKay sewed, kid, black, lace oxford single sole, leather heel	do	do	M D	do	100	20
178	Boots and shoes	Women's, patent leather pump, McKay sewed single sole, Cuban heel	do	do	M D	do		20
179	Calico	American standard prints, 64x60, 7.85 yds. to pound, 28-in. in the gray	do	Factory	M D	Manufacturer's price to jobber		
180	Denims	Massachusetts, #220 28-in. 2.20 yds to the pound	do	do	M D	Manufacturer's price to clothing manufacturer	10	10
181	Drillings	Brown, Pepperell, 2.85 yds to pound, width 29 in. 72x48	do	do	M D	Manufacturer's price to jobber or manufacturer	10	10
182	Drillings	Brown, Mass. D standard 30-in. 2.85 yds to pound 70x48	do	do	M D	Manufacturer's price to jobber	10	10
183	Flannel	Colored, 27 in. 4.20 yd. to the pound	do	do	M D	do	10	10
184	Flannel	Unbleached, 36 in. 3.20 yd to the pound	do	do	M D	do	10	10
185	Ginghams	Amoskeag, 27-in. wide, 6.37 yds to to pound	do	do	M D	Manufacturer's price to jobber or manufacturer	10	10
186	Ginghams	Lancaster, staple weight 6.50 yd to pound 26½ in. wide	do	do	M D	do	10	10
187	Hosiery	Men's, combed yarn, fast black. 188 needles, 17 ounce	do	do	M D	Manufacturer's price to jobber	10 (a)	10

(a) Wt. 1890-1902: 20; 1902-1913: 10.

TABLE I (Continued)

DESCRIPTIONS OF WHOLESALE PRICE QUOTATIONS.

(1) Ref. No.	(2) Commodity	(3) Description	(4) Source of price quotation	(5) Market	(6) Derivation of published figure	(7) Nature of price (or type of transaction)	(8) Weights used in the construction of index numbers and other measures	(9)
							1890–1913 or 1902–1913	1913–1926
188	Hosiery	Women's, silk mercerized, mock seam, 220 needles, weight 1-lb 5-oz.	do	do	M D	do	15*	15
189	Hosiery	Women's single-thread, combed yarn, mock seam, 176 needles, 1-lb 12-oz.	do	do	M D	do	10 (b)	10
190	Muslin	Bleached, 4-4, Fruit of the Loom	do	do	M D	Manufacturer's price to jobber or wholesaler	5	5
191	Muslin	Bleached, 4-4, Lonsdale, 26-in. 4.50 yds to pound, bleached wt.	Manufacturer	Factory	M D	Manufacturer's price to jobber	5	5
192	Muslin	Bleached, 4-4, Rough Rider	do	do	M D	do	5	5
193	Muslin	Bleached, 4-4, Wamsutta nainsook	do	do	M D	do	5	5
194	Percale	Scout, 64x60 38½ in. in the gray	do	do	M D	Manufacturer's price to jobber or shirt manufacturer		

195	Print cloths	27 inch, 64x60. 7.60 yds to pound	do	do	M D	Manufacturer's price to finisher	40	40
196	Sheetings	Brown, 4-4 Indian Head, 2.85 yds to pound	do	do	M D	Manufacturer's price to jobber	10	10
197	Sheetings	Brown, 4-4 Pepperell R, 3.75 yds to pound 64x64	do	do	M D	do	10	10
198	Sheetings	Brown, 4-4 Ware Shoals; Trion L. L. 4 yds to pound, 56x 60	do	do	M D	do	10	10
199	Thread	6-cord, 200 yd. spools J & P Coats, 200 yd spool computed from 100 yd spool price	do	do	M D	do	20	20
200	Underwear	Men's shirts and drawers, 12-12½ lb. to dozen flat fleece	do	do	F M	do		20
201	Underwear	Women's union suits, ribbed, 12 lbs to dozen, carded	do	do	F M	do		20
202	Cotton yarns	Carded, white, mule-spun, northern, cones, 10/1	do	do	M D	Spinner's price to to manufacturer	50	30
203	Cotton yarns	Carded, white, mule-spun, northern, cones, 22/1	do	do	M D	do	50	40
204	Cotton yarns	Carded, twisted, ordinary for weaving 20/2	do	do	M D	do		10
205	Cotton yarns	Carded, twisted, ordinary for weaving, 40/2	do	do	M D	do		20
206	Flannel	White, 4-4, Ballard Vale, No. 3	do	do	F M	Manufacturer's price to jobber	1	1
207	Overcoating	Heavy, 30 to 31 oz.	do	do	M D	Manufacturer's price to jobber or manufacturer	20*	20

(b) Wt. 1890-1902: 15; 1902-1913: 10

TABLE I (Continued)

Descriptions of Wholesale Price Quotations.

(1) Ref. No.	(2) Commodity	(3) Description	(4) Source of price quotation	(5) Market	(6) Derivation of published figure	(7) Nature of price (or type of transaction)	(8) Weights used in the construction of index numbers and other measures	(9)
							1890–1913 or 1902–1913	1913–1926
208	Suiting	Serge, 9½ oz., 55-57 in.	do	do	M D	Manufacturer's price to jobber and wholesaler	20*	20
209	Suiting	Clay worsted, diagonal, 16 ounce, 56-58 in.	do	do	M D	do	25*	25
210	Suiting	Middlesex, wool-dyed blue, 16 oz., 55-56 in.	do	do	F M	Manufacturer's price to jobber	25 (c)	25
211	Suiting	Serge, 11 oz. Fulton Mills, 3192	do	do	M D	Manufacturer's price to wholesaler or jobber	20*	20
212	Trousering	Cotton warp, worsted filling, 11-oz. width 60 inches	do	do	M D	Manufacturer's price to jobber	10*	10
213	Underwear	Shirts and drawers, Merino, full-fashioned, 60 per cent wool, 21 gauge	do	do	M D	Manufacturer's price to retailer	10	10
214	Underwear	Union suits, 33 per cent worsted, 16 lbs to the dozen	do	do	M D	do	10	10

215	Women's dress goods	All wool, broadcloth 54-56 in.	do	do	F M	Manufacturer's price to jobber	20	20
216	Women's dress goods	All wool, French serge, 35-in.	do	do	M D	do	10	10
217	Women's dress goods	All Wool storm serge, double warp, 54-inch	do	do	M D	do	10	10
218	Women's dress goods	Cotton warp, poplar cloth; worsted filling, 32 in. discontinued	do	do	M D	do	3	3
	Substitution	Cotton warp and worsted filled serge,-36 in.	do	do	M D	Manufacturer's price to jobber or manufacturer		
219	Women's dress goods	Cotton warp, Sicilian cloth, 50 in.	do	do	M D	Manufacturer's price to jobber	4	4
220	Worsted yarns	2-32s, crossbred stock, white in skeins	do	do	F M	Manufacturer's price to weaver	10	10
221	Worsted yarns	2-40s, half-blood	The Commercial Bulletin	Eastern markets	M W	Range of price on on Saturday in eastern markets	40	20
222	Worsted yarns	2-50s, fine domestic	do	do	M W	do		20
223	Linen shoe thread	10s, Barbour	Manufacturer	Factory	M D	Manufacturer's price to manufacturer	2	2
224	Silk	Raw, China, Canton, filature, extra extra A	Silk Asso. of America	New York	M D	Price to spinner by importer		20
226	Silk	Raw, Japanese, filatures, Kansai, No. 1	Importer	do	F M	do	70	60
228	Silk	Raw, Japanese, filatures, special, extra, extra	Importer	New York	F M	Importers price to spinner	30	20
229	Silk	Spun yarn, domestic gray spun, 60/1	Silk Asso. of America	do	M D	Spinner's price to weaver		10
230	Silk	Spun yarn, domestic gray spun 60/2, No. 1	do	do	M D	do		10
232	Anthracite coal	Broken, tidewater, average sales realization	Operator	New York Tidewater	M D	Price to jobber	10	10

(c) Wt. 1890-1902: 90; 1902-1913: 25.

TABLE I (Continued)

DESCRIPTIONS OF WHOLESALE PRICE QUOTATIONS.

(1) Ref. No.	(2) Commodity	(3) Description	(4) Source of price quotation	(5) Market	(6) Derivation of published figure	(7) Nature of price (or type of transaction)	(8) Weights used in the construction of index numbers and other measures 1890–1913 or 1902–1913	(9) 1913–1926
233	Anthracite coal	Chestnut, tidewater average sales realization	do	do	M D	do	100	100
234	Anthracite Coal	Egg, tidewater, average sales realization	do	do	M D	do	50	50
235	Anthracite Coal	Stove, tidewater, average sales realization	do	do	M D	do	70	70
236	Bituminous Coal	Kanawha, run of mine	Jobber	F. O. B. Cincinnati	F M	Price to wholesaler and retailer	100	100
237	Bituminous Coal	New River, mine run	do	do	F M	do	100	100
238	Bituminous Coal	Pocahontas, mine run	Sales Agents	F. O. B. Norfolk, Va.	M D	Price to jobber	200	200
239	Coke	Beehive, Connellsville foundry, range of future and prompt shipment	Iron Trade Review	F. O. B. ovens	M W	Range of price on Wednesday	50	50
243	Gasoline	Motor, to garages in steel barrels	Oil, Paint and Drug Reporter	New York	M W	Low price on Saturday		200
244	Matches	Average of Safe Home, Bird's Eye, and Searchlight	Manufacturer	Factory	M D	Manufacturer's price to jobber	10	10

	Petroleum	Crude, California 20 to 20.9 degrees	Oil, Paint and Drug Reporter	Wells	M W	Range of price on Saturday		50
246	Petroleum	Crude, Kansas-Oklahoma, 33 to 33.9 degrees	do	do	M W	do		100
247	Petroleum	Crude, Pennsylvania	N. Y. Journal of Commerce and Commercial Bulletin (Wednesday Edition)	do	M W	Range of price on Tuesday	200	50
248	Petroleum	Refined, for export, New York 110 degrees, fire test, cargo, bulk	Oil, Paint and Drug Reporter	New York	M W	Low price on Saturday	50	50
249	Petroleum	Refined, 150 degrees fire test, water-white; Pa., f. o. b. refinery	National Petroleum News	Refinery	M W	Low price on Monday	80	80
250	Augers	Regular 1 in.	Manufacturers agents	New York	F M	Price to jobber		
251	Butts	Loose-pin, wrought steel, 3½x3½in. planished and plated	Manufacturers	Factory	M D	do		
252	Chisels	Socket firmer, regular, 1 in.	Manufacturers agents	New York	F M	do		
253	Door knobs	Steel, bronze-plated	Manufacturers	do	F M	do		
254	Files	8 in. mill, bastard Nicholson	do	Factory	F M	do		
255	Hammers	Maydole, No. 1½	do	New York	F M	do		
256	Iron Ore	Mesabi, Bessemer 51½ per cent iron	Iron Age	Lower Lake Ports	M W	Price on Tuesday		40
257	Iron Ore	Mesabi, Non-Bessemer 51½ per cent iron	do	do	M W	do		60
258	Locks	Common, mortise, knob locks, 3½-inches	Manufacturer	New York	F M	Price to jobber		
259	Pig Iron	Basic	Iron Age	Valley Furnace	M W	Price on Tuesday	40	40

TABLE I (Continued

DESCRIPTIONS OF WHOLESALE PRICE QUOTATIONS.

(1) Ref. No.	(2) Commodity	(3) Description	(4) Source of price quotation	(5) Market	(6) Derivation of published figure	(7) Nature of price (or type of transaction)	(8) Weights used in the construction of index numbers and other measures	(9)
							1890–1913 or 1902–1913	1913–1926
260	Pig iron	Bessemer	do	Delivered Pittsburgh	M W	do	20	20
261	Pig iron	Foundry, No. 2 northern	do	Pittsburgh	M W	do	20	10
262	Pig iron	Foundry, No. 2, southern, Birmingham	do	Birmingham	M W	do		10
263	Pig iron	Foundry, No. 2, southern, Cincinnati	do	Cincinnati	M W	do		
264	Ferromanganese	British, 80 per cent	do	F. O. B. Atlantic ports	M W	do		10
265	Spiegeleisen	19 and 21 per cent, furnace, spot	Iron Age	Furnace	M W	Range of prices on Tuesday		1
266	Bar iron	Best refined, from store	Manufacturer's Agent	Philadelphia	M D	Manufacturer's price to jobber or manufacturer	5	5
267	Bar iron	From mill, common (Base)	Iron Age	Pittsburgh	M W	Range of prices on Tuesday	5	5
268	Bars	Concrete reinforcing, mill, rolled from billets, 3/4 in. and larger	Engineering News Record	Pittsburgh Mill	F M	Range of price near the first of the month		5

269	Nails	Wire, 8 penny, fence and common (add price differential to the base price)	Iron Age	Pittsburgh	M W	Price on Tuesday	10	10
270	Pipe	Cast-iron, 6 in. class B and heavier	do	F. O. B. New York	M W	Range of price on Tuesday in car lots		10
271	Planes	Jack planes, Sargent No. 414	Manufacturer	New York	F M	Price to jobber		
272	Saws	Crosscut, Disston, No. 2, Champion tooth, 6-foot	do	Philadelphia	F M	do		
273	Saws	Hand, Disston, No. 8, 26 in. skewback	do	do	F M	do		
274	Shovels	Ames, No. 2-cast steel, long handle, round point, back strap-black	do	Factory	M D	do		
275	Steel	Skelp, grooved	Iron Age	Pittsburgh	M W	Price on Tuesday		40
276	Steel	Billets, Bessemer	do	do	M W	do	80	20
277	Steel	Billets, open hearth	do	do	M W	do		60
278	Steel	Merchant Bars	do	do	M W	do		50
279	Steel	Plates, tank, ¼ inch thick 6″-100″	do	do	M W	do		60
280	Steel	Rails, Bessemer, standard	Iron Trade Review	Mill	M W	Price on Wednesday	30	5
281	Steel	Rails, open-hearth, standard	do	do	M W	do		25
282	Steel	Sheets, box annealed No. 27 one pass, cold rolled U. S. Standard, car lots	Iron Age	Mill-Pittsburgh District	M W	Range of prices on Tuesday	50*	50
283	Steel	Structural; beams, channels, etc.	do	Chicago district mills	M W	Price on Tuesday		
284	Steel	Structural, mill beams, channels, etc., base price 3-15″	Engineering News Record	Pittsburgh district mill	F M	Range of price near the first of the month		30
285	Tin	Roofing (terneplate) 8 lb. I. C. package, 20x28 inch	Iron Age	do	M W	Price on Tuesday		3

TABLE I (Continued)

Descriptions of Wholesale Price Quotations.

(1) Ref. No.	(2) Commodity	(3) Description	(4) Source of price quotation	(5) Market	(6) Derivation of published figure	(7) Nature of price (or type of transaction)	(8) Weights used in the construction of index numbers and other measures	(9)
							1890–1913 or 1902–1913	1913–1926
286	Tin	Plate, domestic, coke, f. o. b. Pittsburgh, 14x20 inch	do	Pittsburgh	M W	do	40*	40
287	Trowels	Brick, 10½ in., Johnson's	Manufacturer	New York	F M	Price to wholesaler or jobber		
288	Vises	Solid box, 50 lb.	do	Factory	M D	do		
289	Wire	Fence, barbed, galvanized	Iron Age	Chicago district mills	M W	Price on Tuesday	20	10
290	Wire	Fence, plain, annealed Nos. 6 to 9	do	Pittsburgh	M W	Range of price on Tuesday, in car lots to jobbers		10
291	Wood screws	1 in. No. 10 flathead, iron	Manufacturer	New York	M D	Price to jobber		
292	Aluminum	98-99 per cent, open market	Iron Trade Review	do	M W	Price on Tuesday		10
293	Copper	Ingot, electrolytic, early delivery	Iron Age	Refinery	M W	do	80	80
294	Copper	Sheet, hot rolled (base sizes)	Manufacturer	New York	M D	Price to wholesaler and jobber	10	10
295	Copper	Wire, bare, No. 8, B & S gauge and heavier (base size)	do	Mills	M D	Price to actual consumers and manufacturers of covered wire	20	20

296	Lead	Pig desilverized, for early delivery	Iron Age	New York	M W	Price on Tuesday	20	20
297	Lead	Pipe	Manufacturer	do	M D	Price to jobber	3	3
298	Quicksilver	Spot	Oil, Paint and Drug Reporter	do	M W	Spot price on Saturday	1	1
299	Silver	Bar, fine	Treasury Department	do	M D	Mean of bid and asked price at New York	10	10
300	Tin	Pig, for early delivery	Iron Age	do	M W	Price on Tuesday	10	10
301	Zinc	Sheet, ordinary numbers and sizes, packed in 600 lb. casks	Manufacturer	Mill	M D	Price to jobber and manufacturer	3	3
302	Zinc	Slab, pig, western, early delivery	Iron Age	New York	M W	Price on Tuesday	20	20
303	Douglas fir	No. 1, common boards, f. o. b. mill 1x8″ and 1x10″, S. l. S.	West Coast Lumberman's Association	F. O. B. mills, State of Washington	F M	Price to retailer		20
304	Douglas fir	No. 2 and better, drop siding, f. o. b. mill 1x6″	do	do	F M	do		20
305	Gum	Sap, firsts and seconds, plain sap-4/4	Lumber Manufacturer and Dealer	St. Louis	Bi-weekly	Range of price on every other Wednesday Wholesale price in car lots		10
306	Hemlock	No. 1, northern Pennsylvania, base price	do	New York	do	Price on every other Tuesday Wholesale price in car lots	20	
307	Hemlock	No. 1, northern, No. 1 Piece-stuff-SISIE-2x4x16	do	Chicago	do	Price on every other Friday Wholesale price in car lots		20
308	Maple	Hard and soft, -4/4-firsts and seconds	New York Lumber Trade Journal (Price supplement)	New York	F M	Wholesale selling price to the retail trade	20	
309	Maple	Hard, northern stock, No. 1 common, 4/4	Lumber Manufacturer and Dealer	Chicago	Bi-weekly	Range of price on every other Friday Wholesale price in car lots		20

TABLE I (Continued)

DESCRIPTIONS OF WHOLESALE PRICE QUOTATIONS.

(1) Ref. No.	(2) Commodity	(3) Description	(4) Source of price quotation	(5) Market	(6) Derivation of published figure	(7) Nature of price (or type of transaction)	(8) (9) Weights used in the construction of index numbers and other measures	
							1890–1913 or 1902–1913	1913–1926
310	Oak	White, plain, mixed rock mountain or W. Va. stock 4/4-firsts and seconds	New York Lumber Trade Journal (Price supplement)	New York	F M	Wholesale selling price to the retail trade	50	
311	Oak	White, plain, No. 1 common-4/4	Dealer	Cincinnati	M W	Range of price on Wednesday		50
312	Oak	White, quartered, strictly white, good texture-4/4-firsts and seconds	New York Lumber Trade Journal (Price Supplement)	New York	F M	Wholesale selling price to the retail trade		
313	Pine	White, boards, No. 2 barn, 1x8 in. rough	Wholesale dealers	Buffalo	M W	Range of price on Tuesday	40	40
315	Pine	Yellow, flooring long leaf, B & better, heart rift, 1x3	New York Lumber Trade Journal	New York	F M	Wholesale selling price to retail trade		
316	Pine	Yellow, flooring f. o. b. mill B & better, 1x4 FG sap	Statistical Agency	Hattiesburg (Miss) district	M D	F. O. B. mills		70
317	Pine	Yellow, siding, N. C. Pine surfaced boards No. 2 & better 4/4 edge, under 12 in. rough	New York Lumber Trade Journal	Norfolk, Va.	F M	Wholesale selling price to retailer	130	

318	Pine	Yellow, timbers long leaf f. o. b. mill square edge and sound, dressed 8″ and under, 20″ and under	Statistical Agency	Hattiesburg (Miss) district	M D	F. O. B. mills		60
319	Poplar	Yellow, rough, 1 in. 7 to 17 in. and up, firsts and seconds	New York Lumber Trade Journal	New York	F M	Wholesale selling price to retailer	10	
320	Poplar	No. 1 common-4/4	Wholesale dealer	Cincinnati	M W	Price on Wednesday		10
321	Spruce	Eastern random-2x3 and 4	do	Boston	M W	Range of price on Monday	10	10
322	Lath	Southern yellow pine, No. 1, f. o. b. mill 4 feet, 3/8 inches	Statistical Agency	Hattiesburg (Miss) district	M D	F. O. B. mills		5
323	Shingles	Cypress, 16 in. long Best, all heart, 5 inches wide	Manufacturer	New Orleans district	M D	F. O. B. mills	2	2
324	Shingles	Red cedar, 16 in. long 5/2″ random widths, B grade	Washington and Oregon Shingle Association	F. O. B. mills Washington and Oregon district	M D	F. O. B. mills	10	10
325	Brick	Common, salmon, run of kiln	Manufacturer	Chicago	M D	F O. B. kiln		
326	Brick	Common, red	do	Cincinnati	F M	F. O. B. kiln		
327	Brick	Common, red, domestic	do	New York	Range from first to last of month	Price on barge alongside dock	30	
328	Brick	Common, f. o. b. yard, average 82 yds	Manufacturer's Association		F M	Price at yards		30
330	Cement	Portland, domestic, f. o. b. plant, near Chicago wtihout bags	Manufacturer	Near Chicago	M D	Wholesale price in car lots F. O. B. mill	50*	
331	Cement	Portland, domestic, f. o. b. plant, average of 6 plants	Manufacturers		M D	F. O. B. mills		50
333	Cement	Portland, domestic, f. o. b. plant	do	San Francisco	M D	F. O. B. mill		

TABLE I (Coutinued)

DESCRIPTIONS OF WHOLESALE PRICE QUOTATIONS.

(1) Ref. No.	(2) Commodity	(3) Description	(4) Source of price quotation	(5) Market	(6) Derivation of published figure	(7) Nature of price (or type of transaction)	(8) Weights used in the construction of index numbers and other measures 1890–1913 or 1902–1913	(9) 1913–1926
334	Crushed stone	$1\frac{1}{2}$ in.	Engineering News Record	New York	F M	Cargo or car lots alongside dock		15
335	Doors	White pine, 2 ft. 8 in. by 6 ft. 8 in.; western, 1 3/8 in. thick, 4-panel No. 2 O. G.	Manufacturer	Chicago	M D	Manufacturer to retailer		
336	Gravel	F. O. B. pit, average of 22 plant prices	Manufacturers		F M	F. O. B. pit		10
337	Hollow tile	Building 4x12x12	Engineering News Record	Chicago	F M	Car lots to contractors		10
338	Lime	Common, Mason's lump, f. o. b. plant, average of 15 plant prices	Manufacturers		F M	F. O. B. plant	10	10
340	Sand	Building, f. o. b. pit, average of 31 plant prices	do		F M	F. O. B. pit		5
341	Slate	Roofing No. 1, 10x20″ sea green	do		F M	F. O. B. quarry		1
342	Glass	Plate, polished, area 3 to 5 sq. ft., glazing	do	New York	M D	Manufacturer to jobber	5	5

343	Glass	Plate, polished, area 5 to 10 sq. ft., glazing	do	do	M D	do	5	5
344	Glass	Window, single, A, 25 in., 6 by 8 to 10 by 15 in.	Oil Paint and Drug Reporter for discounts Base price from list of manufacturer	Works	M W	Price at works	5	5
345	Glass	Window, single, B, 25 in., 6 by 8 to 10 by 15 in.	do	do	M W	do	5	5
348	Linseed oil	Raw, car lots, barrels	do	do	M W	do	20	20
349	Putty	In 1, 2, 3 and 5 lb. tin, commercial	New York Journal of Commerce and Commercial Bulletin (Wednesday Edition)	New York	M W	Low price on Tuesday	1	1
350	Rosin	Common to good, yard basis(B) strained	do	do	M W	Range of price on Tuesday		
352	Tar	Per barrel	Morning Star Wilmington, N. C.	Wilmington, N. C.	M W	Prevailing price on Tuesday	5	5
353	Turpentine	Spirits of, southern, barrels, car lots, ex-dock	Journal of Commerce and Commercial Bulletin (Wednesday Edition)	New York	M W	Range of price on Tuesday	10	10
354	Lead, carbonate of	(White lead), American; in oil 100 lb. packages or over	Oil, Paint and Drug Reporter	do	M W	Low price on Saturday Manufacturer to consumer	10	10
355	Zinc, oxide of	(White zinc), American standard; 35 per cent leaded grades in bags; car lots	do	do	M W	do	5	5
356	Acid	Acetic, 28 per cent, barrels	Oil, Paint and Drug Reporter	New York	M W	Low price on Saturday Manufacturer to consumer		1
357	Acid	Muriatic, 20 degree, tanks	do	Works	M W	do	1	1

TABLE I (Continued)

Descriptions of Wholesale Price Quotations.

(1) Ref. No.	(2) Commodity	(3) Description	(4) Source of price quotation	(5) Market	(6) Derivation of published figure	(7) Nature of price (or type of transaction)	(8) Weights used in the construction of index numbers and other measures	(9)
							1890–1913 or 1902–1913	1913–1926
358	Acid	Nitric, 42 degree, carboys	do	New York	M W	do		1
359	Acid	Stearic, triple pressed, distilled in bags	Drug and Chemical Markets	do	M W	Low price on Wednesday		1
360	Acid	Sulphuric, 66 degree, tank cars	Oil, Paint and Drug Reporter	do	M W	Manufacturer to consumer Low price on Saturday	20	20
361	Alcohol	Denatured, 188 proof completely No. 5, barrels	do	do	M W	Manufacturer to consumer Low price on Saturday	10	10
362	Alcohol	Wood, Refined, 95 per cent, drums	do	do	M W	Distillers to wholesalers do	2	2
363	Alum	Lump, ammonia, barrels	do	do	M W	Low price on Saturday	5	5
365	Ammonia	Anhydrous, contracts, cylinders	do	do	M W	Manufacturer to consumer do		5

367	Bleaching Powder	Drums	Oil, Paint and Drug Reporter	Works	M W	Low price on Saturday Manufacturer to wholesaler		1
368	Borax	Crystals, sacks, spot	do	New York	M W	Low price on Saturday Manufacturers to consumers		1
370	Copper sulphate	(Blue vitriol), 99 per cent crystals (large)	do	do	M W	Low price on Saturday Leading manufacturers price		1
372	Formaldehyde	Car lots, barrels	do	New York	M W	Low price on Saturday Leading manufacturers price		1
373	Palm kernel oil	Crude, imported c.i.f. barrels	do	do	M W	Low price on Saturday Importers price to users		1
374	Potash	Caustic, 88-92 per cent, imported, spot, casks	do	do	M W	do		1
376	Soda ash	Light, 58 per cent, barrels, l. c. l.	do	New York	M W	Low price on Saturday Manufacturer to consumer		15
377	Soda, bicarbonate of	American, bags	do	Works	M W	do	2	2
378	Soda, carbonate of	(Sal soda) barrels	do	New York	M W	do		1
379	Soda, caustic	76 and 78 per cent, solid, spot, drums	do	do	M W	do		10
380	Soda, silicate of	42 degrees, turbid, tanks	Drug and Chemical Markets	Works	M W	Low price on Wednesday Manufacturers price		2
381	Sulphur	(Brimstone), stick, crude, car lots, bulk	Oil, Paint and Drug Reporter	Works	M W	Low price on Saturday Manufacturers price	3	3
382	Tallow	Packers' prime	Daily Trade Bulletin (Commercial section) (Tuesday Edition)	Chicago	M W	Range of packers' price on Tuesday	10	10

TABLE I (Continued)

Descriptions of Wholesale Price Quotations.

(1) Ref. No.	(2) Commodity	(3) Description	(4) Source of price quotation	(5) Market	(6) Derivation of published figure	(7) Nature of price (or type of transaction)	(8) Weights used in the construction of index numbers and other measures 1890–1913 or 1902–1913	(9) 1913–1926
384	Acid phosphate	16 per cent basis, bulk	Oil, Paint and Drug Reporter	Baltimore	M W	Low price on Saturday Manufacturer to consumer		10
385	Ammonia	Sulphate, double bags, f. a. s., spot	Drug and Chemical Markets	New York	M W	Low price on Tuesday Manufacturers price		10
386	Bones	Ground, steamed, 1-¼ per cent ammonia, 60 per cent bone phosphate	Oil, Paint and Drug Reporter	Chicago	M W	Low price on Saturday Leading Manufacturers price		1
387	Muriate of potash	80 to 85 per cent, K. C. L., bags	do	New York	M W	do		1
388	Phosphate rock	Florida land pebble, 68 per cent	do	Mines	M W	do		3
389	Soda, nitrate of	(Chile saltpeter), 95 per cent, spot, bags	do	New York	M W	do		10
390	Tankage	Crushed slaughterhouse, 9 and 20 per cent	do	Chicago	M W	Low price on Saturday F. O. B. Chicago		3

391	Acid	Citric, domestic crystals, manufacturers, barrels	do	New York	M W	Low price on Saturday Manufacturer to consumer		1
392	Acid	Tartaric, crystals, U. S. P. manufacturers, domestic sales	do	do	M W	do		1
393	Alcohol	Grain, 188 proof, barrels, U. S. P.	do	do	M W	Low price on Saturday Distillers price to wholesalers	40	40
394	Cream of Tartar	Powdered, domestic, barrels	do	do	M W	Low price on Saturday Manufacturers price		1
395	Epsom salts	U. S. P., 300-lb barrels in 10 barrel lots	Drug and Chemical Markets	do	M W	Low price on Wednesday Producers price		1
396	Glycerin	Refined, chemically pure, in bulk, drums and barrels added	Oil, Paint and Drug Reporter	do	M W	Low price on Saturday Producers price	5	5
397	Opium	Natural, in cases U. S. P.	do	do	M W	Low price on Saturday Importers price to wholesaler	1	1
398	Peroxide of hydrogen	U. S. P., bottles-4 oz., cases	Drug and Chemical Markets	do	M W	Low price on Wednesday Producers price		2
399	Phenol	U. S. P. (carbolic acid) drums	Oil, Paint and Drug Reporter	New York	M W	Low price on Saturday Producers price		5
400	Quinine	Manufacturer's quotations Sulphate, domestic, 100 ounce tins	do	do	M W	Low price on Saturday Manufacturer to wholesaler and jobber	1	1
401	Bed	Combination	Manufacturers' representative	Factory	M D	Average price to retail trade		40
402	Bedroom Chair	All gum, cane seat	do	do	M D	do		3
403	Bedroom Chiffo-rette	Combination	do	do	M D	do		10

TABLE I (Continued)

DESCRIPTIONS OF WHOLESALE PRICE QUOTATIONS.

(1) Ref. No.	(2) Commodity	(3) Description	(4) Source of price quotation	(5) Market	(6) Derivation of published figure	(7) Nature of price (or type of transaction)	(8) Weights used in the construction of index numbers and other measures	(9)
							1890–1913 or 1902–1913	1913–1926
404	Bedroom Dresser	Combination	do	do	M D	do		10
405	Bedroom Chairs	Quartered oak rocker	Dealer	Chicago	M D	Price to retailer	10	2
406	Bedroom Sets	Iron bedstead, quartered oak dresser, and plain oak washstand	do	do	M D	do	20	10
407	Buffet	Combination	Manufacturers representative	Factory	M D	Average price to retail trade		40
408	Dining Room Chair	All gum leather, slip seat	do	do	M D	do		20
409	Dining Room Table	Extension combination	do	do	M D	do		10
410	Davenport	Standard pattern	do	do	M D	do		40
411	Table	Library, combination	do	do	M D	do		10
412	Kitchen Chairs	Hardwood,bowback	Dealer	Chicago	M D	Price to retailer	2	2
413	Refrigerator	Lift-top type	Manufacturers representative	Factory	M D	Average price to retail trade		10
414	Kitchen Tables	Hardwood base, 24 x 42 in.	Dealer	Chicago	M D	Price to retailer	2	2

415	Blankets	Cotton, 2 lb. to the pair 54 x 74″ 42x38 ends per square inch	Mill agents	Factory	M D	Price to jobber	2	2
416	Blankets	Woolen, 4 to 15 lb. to the pair	Manufacturers	do	F M	do	2	2
417	Carpets	Axminster, Bigelow, 3/4	do	do	M D	Price to retailer	20	20
418	Carpets	Brussels, 5-frame, Bigelow	do	do	M D	do	10	10
419	Carpets	Wilton, 5-frame, Bigelow	do	do	M D	do	10	10
420	Carvers	Stag handles, 8-in.	do	do	F M	Price to wholesaler or jobber	1	1
421	Knives and forks	Cocobolo handles, metal bolsters	do	do	F M	do	1	1
422	Pails	Galvanized iron, 10 quart	Manufacturers	Factory	M D	Price to jobber or wholesaler	1	1
423	Sheeting:Bleached	10-4, Pepperell, width 90 in. 72x72 ends per square inch	Mill agents	Factory	M D	Price to jobber or manufacturer	10	10
424	Sheeting:Bleached	10-4, Wamsutta, P. L.	Manufacturers	do	M D	Price to jobber or manufacturer	20	20
425	Nappies	4-in, common	do	do	M D	Price to jobber	1	1
426	Pitchers	½ gal., common	do	do	M D	do	6	6
427	Tumblers	Common, 1/3 pint	do	do	M D	do	2	2
428	Plates	White granite, 7 inch	do	do	F M	do	6	6
429	Teacups and saucers	White granite, teas with handles	do	do	F M	do	3	3
430	Tickings	Amoskeag, A. C. A. width 32 inches, 2.05 yards to the pound	do	do	M D	do	3	3
431	Tubs	Galvanized iron, No. 3	do	do	M D	Price to jobber and wholesaler	1	1
432	Bran	In 100 pound sacks, prompt shipment, car lots	Northwestern miller	Minneapolis	M W	Range of price on Tuesday		15
433	Cottonseed meal	Prime, 8 per cent Ammonia	Manufacturer	F. O. B. Memphis	F M	Price to jobber	30	30

TABLE I (Continued)

Descriptions of Wholesale Price Quotations.

(1) Ref. No.	(2) Commodity	(3) Description	(4) Source of price quotation	(5) Market	(6) Derivation of published figure	(7) Nature of price (or type of transaction)	(8) Weights used in the construction of index numbers and other measures	(9)
							1890–1913 or 1902–1913	1913–1926
434	Linseed meal	Bags	Oil, Paint and Drug Reporter	New York	M W	Low price on Saturday mills to dealers		2
435	Mill feed	Middlings, standard 100 lb. jute sacks, car lots	Northwestern miller	Minneapolis	M W	Range of price on Tuesday		20
436	Leather	Chrome calf, dull or bright range of B grades	Shoe and Leather Reporter	Eastern Markets	F M	Price to shoe manufacturers	40	30
437	Leather	Glazed kid, top grades, from Brazilian skins, black	do	do	F M	do		30
438	Leather	Harness oak, Cal., No. 1 or B selections	Hide and Leather	Middle Western mkts.	F M	Price to manufacturers of harness,etc.	20	5
439	Leather	Side, chrome, tanned, "B" grade	Shoe and Leather Reporter	Eastern Markets	F M	Price to shoe manufacturers		20
440	Leather	Sole oak, in sides, middle weights, tannery run	do	do	F M	do	25	5
441	Leather	Sole oak, scoured backs, heavy civilian trade	do	do	F M	do	25	25

442	Leather	Sole union backs, tannery run, steer	Shoe and Leather Reporter	New York	M W	Range of price on Wednesday		20
443	Paper	Newsprint, rolls, contract	Paper Trade Journal	Mills	M W	Range of price on Tuesday	50	50
						Manufacturers price to publishers		
444	Paper	Wrapping, Manila, No. 1 jute	New York Journal of Commerce and Commercial Bulletin (Wednesday Edition)	New York	M W	Range of price on Tuesday	50	50
445	Wood pulp	Sulphite, domestic, unbleached, news grade	Paper Trade Journal	Mills	M W	Range of price on Tuesday		50
						Price to manufacturers of paper		
447	Hemp	Manila, fair, current shipment	New York Journal of Commerce and Commercial Bulletin (Wednesday Edition)	New York	M W	Range of price on Tuesday		5
						Importers' price to manufacturer		5
448	Jute	Raw, shipment, medium grades						
449	Paraffin	Lubricating oil; 903 specific gravity	Importers Oil, Paint and Drug Reporter	New York	F M	Importers' price to manufacturer	3	3
				New York	M W	Low price on Saturday		60
						Producers' price to consumer		
450	Rope	Manila, base size and larger, first grade 3 strands	Hardware Age	New York	M W	Price on Thursday to jobbers	10	10
451	Rubber	Para island, fine	N. Y. Journal of Commerce and Commercial Bulletin (Wednesday Edition)	do	M W	Range of price on Tuesday	80	80
						Importer to jobber manufacturer		
452	Sisal	Mexican, current shipment						
453	Soap	Laundry, price per box of 100 bars (75 lbs.)	do	do	M W	do		5
			Manufacturer	Factory	M D	Price to wholesaler of jobber		30

TABLE I (Concluded)

Descriptions of Wholesale Price Quotations.

(1) Ref. No.	(2) Commodity	(3) Description	(4) Source of price quotation	(5) Market	(6) Derivation of published figure	(7) Nature of price (or type of transaction)	(8) Weights used in the construction of index numbers and other measures	(9)
							1890–1913 or 1902–1913	1913–1926
454	Soap	Laundry, average price per box of 100 11 oz. cakes	Manufacturer	Factory	M D	Price to wholesaler or jobber		20
455	Starch	Laundry, 50 lb. boxes bulk	Jobbers	New York	F M	Price to retailers and small jobbers at New York	20	20
456	Tobacco	Plug, 15 oz. to the plug	Manufacturers	do	M D	Price to jobber	30	30
457	Tobacco	Smoking, granulated, 1 1/8 oz. bags, Blackwell's Bull Durham	Jobbers	do	M D	Price to retailers	80	80

TABLE II

Measures of Monthly Variability of Commodity Prices, at Wholesale, 1890-1926[1]

(Mean deviation as percentage of mean annual price)

A Farm products

Year	Corn (2) (crop years)[2]	Oats (4) (crop years)[2]	Wheat (6) (crop years)[2]	Cattle, steers (13)	Hogs, light (16)	Cotton (25) (crop years)[2]	Potatoes (51) (crop years)[2]	Wool (56)
1890	8.7	10.2	4.7	2.6	5.7	7.8	10.4	.8
1891	11.4	5.2	5.7	4.3	13.9	6.3	6.2	3.3
1892	2.7	3.6	3.2	5.3	10.2	8.9	9.7	1.4
1893	15.6	12.1	4.0	3.8	10.5	4.1	10.7	10.3
1894	11.6	3.6	9.3	9.4	6.9	8.9	10.0	6.3
1895	7.9	4.7	5.0	6.3	9.8	4.9	10.1	4.0
1896	6.8	3.9	9.1	6.0	7.5	4.5	4.4	4.8
1897	7.3	12.1	13.0	1.4	6.5	6.2	10.8	12.1
1898	3.5	7.1	4.2	2.3	4.2	5.0	20.0	1.6
1899	9.2	2.7	4.2	7.4	7.4	14.2	13.3	8.5
1900	13.9	10.5	2.2	2.7	4.8	8.6	16.2	9.3
1901	4.1	8.4	3.2	3.6	4.9	5.4	5.7	.9
1902	7.0	6.3	2.5	7.1	7.0	12.2	11.4	4.9
1903	6.3	6.1	8.0	2.6	10.5	11.1	28.1	3.8
1904	7.7	3.1	4.7	6.0	7.2	14.3	14.0	1.0
1905	6.2	8.0	4.0	2.8	6.4	3.8	11.6	2.2
1906	12.5	13.0	7.6	5.4	3.7	6.8	11.6	1.1
1907	10.5	3.7	3.2	4.2	7.4	4.9	9.5	1.8
1908	6.7	6.8	12.1	6.0	10.8	8.6	18.2	2.0
1909	5.6	6.2	4.6	7.0	8.1	4.9	18.2	1.2
1910	13.7	8.8	5.4	5.3	7.0	3.9	13.9	2.8
1911	5.9	7.7	4.7	10.1	8.0	9.5	21.5	3.8
1912	13.1	7.5	2.0	8.8	7.8	3.4	4.0	2.1
1913	5.9	2.2	4.1	1.5	5.4	2.8	5.3	5.3
1914	5.0	8.4	14.7	4.7	5.4	10.8	9.5	4.3
1915	7.8	8.4	6.9	5.5	6.1	5.7	25.8	2.7
1916	27.7	14.0	18.7	6.4	5.3	13.9	28.3	5.9
1917	5.8	12.2	4.8	9.7	10.7	8.2	17.3	16.5
1918	11.8	5.1	4.3	11.1	4.7	8.0	9.3	.6
1919	11.4	13.8	9.6	5.0	13.2	7.2	35.2	9.3
1920	10.8	16.5	19.3	7.5	8.7	33.5	29.0	24.6
1921	9.2	4.0	4.5	5.8	11.2	9.0	9.2	4.4
1922	8.6	6.1	3.6	12.2	8.5	9.1	17.2	7.9
1923	16.3	7.5	4.2	5.7	7.1	7.5	14.3	4.8
1924	8.6	6.9	9.2	3.5	14.1	3.6	13.2	6.7
1925	4.3	1.9	4.5	12.4	7.9	6.7	17.4	10.3
1926				3.3	5.9			3.9

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[1] The commodities included in this and the following tables, except where otherwise noted, are those for which prices have been compiled by the United States Bureau of Labor Statistics. Full descriptions of the price quotations employed are given in Table I. The commodities have been numbered to facilitate cross-reference.

[2] Each crop year measure relates to the period *beginning* in the year opposite which the entry appears. See page 41 for a statement concerning the crop years.

TABLE II (Cont.)

Measures of Monthly Variability of Commodity Prices, at Wholesale, 1890-1926

(Mean deviation as percentage of mean annual price)

B Minerals and mineral products

Year	Anthracite coal (233)	Bituminous coal (237)	Coke (239)	Petroleum, crude (247)	Pig iron (259)	Copper, ingot (293)	Lead, pig (296)	Tin, pig (300)
1890	1.4	7.5	5.4	9.5	3.1	7.0	9.8	2.8
1891	1.5	7.9	1.7	8.4	.2	6.9	2.4	.9
1892	11.6	.0	3.4	5.0	4.5	4.4	3.3	2.3
1893	3.5	2.6	18.3	9.8	2.4	6.4	5.7	3.2
1894	6.8	7.9	12.7	3.1	1.8	3.2	3.1	11.4
1895	5.5	3.2	12.0	15.8	7.5	8.3	3.7	2.3
1896	6.8	8.3	.0	8.3	2.5	3.6	3.9	1.7
1897	2.2	6.0	8.2	12.1	2.5	2.6	9.7	1.5
1898	2.5	6.2	3.6	16.9	1.7	3.4	3.7	7.9
1899	4.1	1.8	17.9	12.9	19.9	5.6	3.3	11.4
1900	6.6	12.5	23.6	14.9	15.9	1.8	5.1	5.7
1901	3.4	4.2	4.1	5.4	1.3	1.2	.0	4.0
1902	6.2	46.1	20.7	6.1	10.8	2.7	.6	6.2
1903	3.3	26.5	27.6	6.2	13.6	5.9	3.6	4.7
1904	3.4	11.9	8.5	5.5	3.2	3.9	3.1	2.8
1905	3.4	.0	16.4	6.9	2.3	4.8	6.2	5.3
1906	2.5	3.2	11.4	1.5	11.4	7.0	3.9	5.2
1907	3.2	4.6	11.9	4.0	12.1	19.3	12.1	9.7
1908	3.3	3.0	9.6	.0	3.3	3.5	6.7	3.9
1909	3.3	2.1	20.4	6.0	5.1	2.4	2.6	2.8
1910	3.3	1.5	16.2	3.3	5.8	3.0	2.4	5.1
1911	2.8	1.1	5.1	.0	1.6	1.8	1.1	4.3
1912	2.2	1.8	17.8	5.3	6.8	7.6	6.0	4.5
1913	3.0	4.0	13.9	3.4	5.8	4.4	2.5	8.6
1914	2.8	2.7	6.0	20.9	1.6	7.8	2.9	8.0
1915	2.6	2.7	12.1	1.1	10.1	10.4	11.4	17.5
1916	2.0	27.7	25.6	4.8	13.2	6.4	8.3	8.6
1917	4.5	20.4	21.7	6.2	18.2	12.6	16.5	11.4
1918	6.2	4.9	.0	1.1	1.4	4.9	6.8	7.4
1919	2.2	6.3	14.3	4.2	8.1	12.6	9.9	11.2
1920	7.8	17.5	32.6	3.7	8.0	8.5	12.0	17.1
1921	1.4	8.5	22.1	22.9	13.7	3.0	4.6	7.6
1922	.3	24.7	38.1	4.7	15.7	3.1	12.3	6.0
1923	3.2	15.7	22.3	16.5	9.6	8.2	7.5	5.9
1924	1.5	4.7	12.3	14.7	5.5	3.4	7.5	6.8
1925	2.2	3.9	25.0	6.1	6.6	2.9	7.3	4.6
1926	.0	10.4	30.7	4.2	4.0	1.4	5.3	4.4

TABLE II (Conc.)

Measures of Monthly Variability of Commodity Prices, at Wholesale, 1890-1926

(Mean deviation as percentage of mean annual price)

C Fabricated goods

Year	Men's shoes (166)	Print cloths (195)	Suiting (210)	Nails, wire (269)	Steel billets (276)	Steel rails (280)	Lead pipe (297)	Leather (441)
1890	.0	2.6	.0	7.3	7.5	5.6	10.5	1.9
1891	.0	1.6	.0	4.1	1.8	.5	2.4	1.3
1892	.0	7.2	.0	2.0	2.8	.0	.6	.9
1893	.0	12.5	2.6	3.6	8.5	4.7	.0	.8
1894	.0	2.7	.0	3.4	6.3	.0	5.3	4.3
1895	.0	7.5	1.3	27.5	15.8	10.0	.0	10.8
1896	.0	3.5	.0	9.8	5.3	.0	4.1	1.8
1897	.0	3.5	.0	3.7	4.9	6.7	7.8	3.5
1898	3.4	4.0	.0	4.5	2.3	1.3	4.3	1.2
1899	.0	4.3	.0	17.7	22.8	16.0	1.7	3.3
1900	.0	5.9	.0	16.9	25.5	10.8	7.8	4.9
1901	.0	7.4	4.6	2.2	6.8	3.2	5.8	4.3
1902	.0	4.4	1.3	2.9	4.2	.0	.6	1.5
1903	.0	2.2	.0	1.8	7.2	.0	3.5	3.1
1904	.0	10.9	.5	6.1	4.9	.0	3.1	2.4
1905	1.5	13.0	2.0	.4	4.6	.0	5.6	1.7
1906	4.6	4.4	.0	1.2	3.1	.0	2.7	1.2
1907	.0	7.4	.0	1.1	2.1	.0	19.0	2.2
1908	.0	6.8	.0	2.4	5.3	.0	5.5	1.1
1909	1.2	5.7	.0	4.6	5.6	.0	2.7	1.5
1910	.8	4.8	2.9	3.8	5.6	.0	3.7	4.4
1911	.0	5.4	.5	3.5	6.0	.0	.4	.4
1912	1.4	6.5	2.9	3.2	10.5	.0	5.4	1.8
1913	.6	3.6	2.6	3.8	9.1	.0	3.0	2.1
1914	1.3	9.9	1.5	1.5	3.1	.0	1.3	1.2
1915	.2	6.4	1.7	5.4	12.4	.0	13.6	4.3
1916	5.7	14.4	6.7	6.3	10.4	8.9	7.5	8.6
1917	.0	14.5	14.5	8.6	21.4	.0	15.2	.7
1918	11.4	8.1	3.7	.0	1.0	3.1	4.8	2.5
1919	12.9	20.9	3.2	5.1	5.9	7.2	6.1	8.9
1920	6.2	26.7	7.7	5.2	8.7	2.1	7.6	8.0
1921	1.8	14.2	2.9	4.9	14.0	3.2	6.9	3.5
1922	1.6	7.8	6.4	4.4	10.8	2.5	12.8	1.6
1923	1.8	6.8	2.5	2.8	4.6	.0	3.6	6.6
1924	.0	3.1	1.1	2.8	3.8	.0	4.8	3.0
1925	.2	3.2	2.2	2.9	2.2	.0	4.8	4.2
1926	.0	6.1	3.7	.0	.0	.0	3.6	3.7

TABLE III

MEASURES OF MONTHLY VARIABILITY OF SIX GENERAL ECONOMIC SERIES, 1890-1926

(Mean deviation as percentage of mean annual value)

Year	Yield on fifteen railroad bonds[1]	American Tel. and Tel. index of general business	Index of industrial stock prices (Dow-Jones[2])	Pig iron production	Discount rate on 60–90 day commercial paper	Interest rate on call loans
1890	1.7	2.8	5.5	2.1	12.2	27.7
1891	.8	5.7	2.9	14.3	5.4	21.1
1892	.5	1.7	2.9	6.2	16.6	50.9
1893	2.5	12.0	18.2	29.8	25.2	45.2
1894	.7	4.9	4.2	22.1	5.8	7.7
1895	2.0	5.1	7.7	11.1	15.6	33.9
1896	1.9	5.3	7.8	17.3	21.4	42.8
1897	1.2	4.7	10.0	9.8	7.1	23.4
1898	1.5	1.8	5.9	3.7	17.0	23.2
1899	1.0	2.9	4.6	6.3	19.9	40.5
1900	.7	5.0	6.3	12.0	7.7	41.2
1901	.6	1.5	4.4	4.5	9.0	27.5
1902	1.0	1.2	1.7	2.7	11.8	33.0
1903	1.6	4.5	13.4	12.7	6.6	36.2
1904	1.3	2.3	11.6	12.8	8.2	29.9
1905	2.4	2.4	5.5	5.8	12.8	60.9
1906	1.0	1.7	2.1	4.4	8.6	41.6
1907	3.4	5.6	12.9	9.6	10.0	63.7
1908	2.4	2.9	10.1	14.6	15.8	33.1
1909	.6	4.9	5.7	14.4	15.0	36.2
1910	.7	3.1	5.2	9.9	7.9	19.5
1911	.3	.6	3.0	6.1	6.9	14.6
1912	.8	1.7	3.4	6.1	15.8	36.3
1913	1.7	2.3	2.6	6.4	5.1	19.1
1914	1.9	5.9	3.2	9.2	20.3	48.1
1915	1.5	7.5	17.1	18.4	7.1	4.4
1916	.8	1.7	4.6	2.6	7.7	21.4
1917	4.9	2.2	8.8	4.8	10.5	26.2
1918	2.0	3.0	2.5	8.8	1.4	9.4
1919	2.7	5.1	9.5	12.8	2.1	22.7
1920	3.1	5.2	8.0	4.7	8.6	6.8
1921	2.9	4.0	4.7	25.6	13.0	11.8
1922	1.8	6.2	5.5	16.4	6.8	7.5
1923	.8	3.4	5.0	8.6	2.6	3.2
1924	1.8	6.8	5.8	18.1	15.3	28.2
1925	.8	2.7	8.7	8.2	5.6	9.2
1926	.7	.8	4.8	3.2	3.7	5.8

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[1] Source: Standard Trade and Securities Service. For the period prior to 1900 Mitchell's figures for the yields on 10 railroad bonds have been used.

[2] See the note to Table 5 concerning the source of the stock price index.

TABLE IV

Measures of Monthly Variability of Commodity Prices, at Wholesale, 1890-1925

Calendar Year Measures
Averages, by Periods

(Commodities arranged within each group in order of magnitude of the measures in column 9)

(1) Ref. No.	(2) Commodity	(3) 1890–1897	(4) 1898–1905	(5) 1906–1913	(6) 1914–1921	(7) 1922–1925	(8) 1890–1925 inclusive	(9) 1890–1925 excluding 1914–1921
	Farm products							
53	Rice	3.3	4.4	3.2	9.8	4.2	5.1	3.7
56	Wool: fine clothing	5.4	4.0	2.5	8.5	7.4	5.4	4.5
59	Wool: medium	5.7	4.3	3.0	7.3	8.1	5.4	4.9
14	Cattle: good to choice	5.0	4.1	5.1	5.9	6.7	5.2	5.0
13	Cattle: choice to prime	4.9	4.3	6.0	7.0	8.4	5.9	5.6
6	Wheat	7.3	7.2	5.7	11.0	7.0	7.7	6.8
37	Hay	7.1	5.4	8.6	9.1	6.8	7.5	7.0
22	Beans	7.6	6.4	6.6	9.5	9.4	7.7	7.2
34	Flaxseed	8.5	8.6	6.4	10.0	6.7	8.2	7.7
15	Hogs: heavy	9.2	6.5	7.1	7.7	9.1	7.8	7.8
16	Hogs: light	8.9	6.6	7.3	8.2	9.4	7.9	7.8
25	Cotton	7.5	8.7	7.8	14.8	8.5	9.6	8.1
42	Hides	10.6	6.0	7.7	10.5	12.0	9.1	8.7
5	Rye	11.2	6.1	5.7	13.7	15.1	9.8	8.7
1	Barley	11.3	6.3	10.7	13.4	6.1	9.9	9.0
2	Corn	12.0	7.0	11.2	10.2	11.6	10.3	10.3
4	Oats	12.1	10.1	11.7	10.4	8.7	10.8	10.9
19	Sheep: wethers	11.6	11.7	11.5	11.9	10.8	11.6	11.5
17	Sheep: ewes	12.9	11.5	12.1	15.1	14.4	13.1	12.5
47	Milk	14.6	12.9	12.4	13.5	8.5	12.8	12.6
44	Hops	19.2	14.1	23.2	24.5	25.8	20.8	19.8
31	Eggs	23.0	22.0	24.0	20.5	23.9	22.5	23.1
51	Potatoes	29.0	26.0	23.6	25.9	28.0	26.3	26.4
49	Onions	28.4	25.8	28.8	32.9	32.9	29.4	28.4
	Foods							
104	Bread: Cincinnati	.0	.5	.5	5.0	.5	1.4	.3
106	Bread: New York	1.8	.5	.0	5.2	1.0	1.8	.8
111	Crackers: oyster	1.1	2.5	.1	6.3	.6	2.3	1.2
148	Starch: corn	2.2	2.4	.3	4.2	.6	2.1	1.5
112	Crackers: soda	2.7	2.4	.2	6.3	.6	2.6	1.6
161	Vinegar	2.4	2.5	3.6	13.9	4.2	5.4	3.0
141	Molasses	4.1	2.6	1.6	5.8	5.5	3.7	3.1
116	Salmon	3.3	3.7	1.8	6.3	5.0	3.9	3.2
152	Tea	4.7	3.7	2.3	5.0	1.0	3.6	3.2
113	Cod	4.3	5.1	3.8	3.7	4.5	4.3	4.4
64	Beef: fresh	5.4	4.2	5.4	5.8	4.9	5.2	5.0
150	Sugar: granulated	6.6	4.4	4.4	10.4	8.1	6.7	5.6
68	Beef: salt	4.6	6.2	6.2	10.4	5.9	6.7	5.7
145	Pepper	6.6	3.1	4.9	7.0	10.8	6.0	5.7

TABLE IV (Cont.)

(1) Ref. No.	(2) Commodity	(3) 1890–1897	(4) 1898–1905	(5) 1906–1913	(6) 1914–1921	(7) 1922–1925	(8) 1890–1925 inclusive	(9) 1890–1925 excluding 1914–1921
	Foods (cont.)							
146	Salt	6.4	8.3	4.8	4.0	2.5	5.5	5.9
131	Raisins	7.9	6.2	3.6	7.7	7.3	6.5	6.1
120	Flour: wheat, standard patents[1]	5.6	6.3	4.4	11.5	6.9	6.6	5.6
119	Flour: wheat, winter straights	6.2	5.8	6.1	10.8	7.0	7.2	6.2
69	Hams	6.3	5.3	6.7	7.4	7.2	6.5	6.3
114	Herring[2]	11.8	6.5	2.6	6.4	.6	6.3	6.3
138	Lard	7.8	5.4	5.6	8.6	7.0	6.9	6.4
109	Coffee	7.0	6.1	6.2	12.7	8.4	8.1	6.7
140	Meal: corn, yellow table	7.7	5.1	5.9	11.1	10.2	7.8	6.8
139	Meal: corn, fine white	7.5	5.2	5.7	13.5	11.3	8.3	6.9
74	Pork: cured, salt mess	8.0	6.1	6.9	9.0	6.2	7.3	6.9
158	Cottonseed oil	6.2	6.8	8.8	10.8	6.2	7.9	7.1
149	Sugar: raw	8.5	5.1	6.8	12.4	9.2	8.3	7.1
117	Flour: rye	8.4	4.3	5.8	12.2	14.1	8.4	7.3
76	Pork: cured, short clear sides	8.3	6.2	7.3	8.2	10.1	7.8	7.7
75	Pork: cured, rough sides	8.5	6.4	7.5	8.2	10.1	7.9	7.8
129	Currants	13.4	11.1	4.5	11.8	3.5	9.5	8.8
115	Mackerel	8.8	10.1	8.2	9.2	7.6	8.9	8.8
130	Prunes	11.6	5.7	10.4	8.3	7.9	8.9	9.0
99	Cheese	11.2	10.6	7.4	7.9	7.5	9.1	9.4
90	Butter: creamery firsts, N. Y.	10.8	9.7	9.1	8.6	8.8	9.5	9.7
71	Mutton	9.2	10.1	10.4	11.9	8.6	10.2	9.7
89	Butter: creamery extra, N. Y.	13.6	10.9	9.6	8.9	9.5	10.6	11.1
95	Butter: creamery extra, St. Louis	13.7	11.0	9.6	9.0	9.7	10.7	11.2
128	Apples	16.7	10.3	9.8	11.4	6.4	11.4	11.4
	Cloths and clothing							
213	Underwear: shirts and drawers	.0	.0	.0	2.3	.5	.6	.1
214	Underwear: union suits[3]	.0	.0	.0	9.4	1.6	2.1	.2
174	Men's shoes: vici kid	.0	.6	1.0	5.3	.5	1.6	.5
223	Linen shoe thread	.7	.3	.0	3.5	2.0	1.2	.6
166	Men's shoes: black calf	.0	.6	1.1	4.9	.9	1.6	.6
199	Cotton thread	.3	.0	1.6	6.4	2.3	2.1	.9
218	Poplar cloth	.6	1.6	.6	5.1	1.2	1.9	1.0
177	Women's shoes	.6	1.3	1.6	7.0	.3	2.4	1.0
210	Suiting: Middlesex	.5	1.1	1.1	5.2	3.0	2.1	1.2
219	Sicilian cloth	.2	1.5	2.6	5.7	1.6	2.4	1.4
184	Flannel: unbleached	.0	3.1	1.9	10.2	2.2	3.6	1.8
173	Men's shoes: chocolate elk	1.4	1.8	3.1	3.8	.7	2.3	1.9
216	French serge	2.2	2.0	2.1	6.0	1.2	2.9	2.0
183	Flannel: colored	.0	3.6	2.4	8.9	2.3	3.6	2.0
206	Flannels: white	2.9	2.1	1.0	3.5	2.5	2.4	2.1
193	Muslin: Wamsutta	1.3	3.0	3.5	7.4	1.2	3.5	2.4
215	Broadcloth[3]	3.3	3.0	1.1	5.8	2.8	3.2	2.5
217	Storm serge	2.9	3.0	2.1	8.6	2.1	3.9	2.6
192	Muslin: Rough Rider	1.5	1.7	3.8	11.6	5.3	4.7	2.7
186	Ginghams: Lancaster	3.2	2.0	3.9	5.7	2.0	3.5	2.9
185	Ginghams: Amoskeag	2.1	2.7	4.4	7.5	2.5	4.0	3.0
181	Drillings: Pepperell	3.4	3.6	1.1	9.1	5.4	4.4	3.1

TABLE IV (Cont.)

(1) Ref. No.	(2) Commodity	(3) 1890–1897	(4) 1898–1905	(5) 1906–1913	(6) 1914–1921	(7) 1922–1925	(8 1890–1925 inclusive	(9) 1890–1925 excluding 1914–1921
	Cloths and clothing (cont.)							
196	Sheetings: 4-4 Indian Head	2.7	2.6	2.8	9.1	5.9	4.5	3.1
179	Calico	2.5	2.8	4.9	11.4	2.4	5.1	3.2
180	Denims	1.8	4.0	3.4	7.0	4.4	4.1	3.3
221	Worsted yarns: 2-40's	4.6	3.4	1.6	9.1	3.8	4.6	3.3
182	Drillings: Mass. D	3.6	3.2	2.7	11.9	4.7	5.3	3.4
197	Sheetings: 4-4 Pepperell R	3.3	4.2	3.1	11.0	4.4	5.3	3.6
191	Muslin: Lonsdale	3.4	4.5	4.5	9.7	2.9	5.2	4.0
198	Sheetings: 4-4 Ware Shoals[4]	4.3	3.0	4.1	13.5	4.8	6.1	4.0
190	Muslin: Fruit of the Loom	3.5	4.3	5.0	9.1	2.7	5.2	4.0
220	Worsted yarns: 2-32's	4.4	3.8	3.8	8.0	5.0	5.0	4.1
228	Silk: raw, Japanese, extra-extra	5.1	4.4	3.8	12.3	6.5	6.4	4.7
203	Cotton yarns: carded, cones 22/1[5]	3.8	5.6	4.4	12.7	5.3	6.7	4.8
226	Silk: raw, Japanese, Kansai, No. 1	5.5	4.8	4.4	14.1	7.3	7.2	5.2
202	Cotton yarns: carded, cones 10/1[5]	4.3	6.1	5.1	13.7	5.9	7.4	5.4
195	Print cloths	5.1	6.5	5.6	14.4	5.2	7.6	5.7
	Fuel and lighting							
244	Matches	.4	.9	.0	1.2	1.9	.8	.7
232	Anthracite coal: broken	1.1	1.9	.3	3.7	1.7	1.8	1.2
249	Petroleum: refined 150 ° fire test[6]	2.7	3.3	2.0	4.1	3.2	3.0	2.7
234	Anthracite coal: egg	4.1	4.0	3.0	3.9	1.7	3.5	3.4
235	Anthracite coal: stove	4.9	4.1	2.9	3.9	1.8	3.7	3.6
233	Anthracite coal: chestnut	4.9	4.1	3.0	3.7	1.8	3.7	3.7
248	Petroleum: refined for export	3.7	5.9	1.8	5.3	3.1	4.0	3.7
236	Bituminous coal: Kanawha	5.7	5.4	2.1	9.4	9.2	6.0	5.0
238	Bituminous coal: Pocahontas	2.3	9.9	2.1	9.1	10.1	6.4	5.6
247	Petroleum: crude	9.0	9.4	2.9	8.1	10.5	7.7	7.6
237	Bituminous coal: New River	5.4	13.7	2.7	11.4	12.2	8.7	8.0
239	Coke	7.7	15.3	13.3	16.8	24.4	14.5	13.9
	Metals and metal products							
287	Trowels	.0	.0	.0	4.2	.1	1.0	.0
272	Saws: crosscut	.0	.0	.0	3.5	.9	.9	.1
273	Saws: hand	.0	.0	.0	4.3	.9	1.1	.1
271	Planes	.3	.5	1.4	3.6	.0	1.3	.6
255	Hammers	.2	1.0	.0	3.0	3.2	1.3	.8
274	Shovels	.3	1.0	.4	4.0	2.9	1.6	.9
250	Augers	1.4	1.7	1.1	5.2	.0	2.1	1.2
254	Files	1.1	1.7	.4	4.3	2.0	1.9	1.2
252	Chisels	.7	2.3	2.5	3.7	.0	2.1	1.6
251	Butts	2.6	1.5	.9	3.7	2.9	2.3	1.9
280	Steel rails	3.4	3.9	.0	3.1	.6	2.4	2.2
288	Vises	2.0	3.2	1.4	5.6	3.2	3.1	2.4
258	Locks	1.4	3.2	1.8	6.0	4.0	3.2	2.4
253	Door knobs	2.1	3.2	1.5	6.6	4.6	3.5	2.6
299	Silver	3.7	3.0	2.7	7.4	2.5	4.0	3.0
298	Quicksilver	3.3	2.2	3.2	17.5	7.0	6.6	3.5
301	Zinc: sheet	3.4	3.8	3.4	9.6	4.1	4.9	3.6
294	Copper: sheet	5.3	2.2	5.2	7.1	3.6	4.8	4.1
291	Wood screws	5.8	4.1	1.5	8.1	7.8	5.2	4.4

TABLE IV (Cont.)

(1) Ref. No.	(2) Commodity	(3) 1890–1897	(4) 1898–1905	(5) 1906–1913	(6) 1914–1921	(7) 1922–1925	(8) 1890–1925 inclusive	(9) 1890–1925 excluding 1914–1921
	Metals and metal products (cont.)							
295	Copper: wire	4.6	4.1	5.4	7.7	3.7	5.2	4.5
297	Lead: pipe	3.8	4.1	5.3	7.9	6.5	5.4	4.7
289	Wire: fence	5.2	6.0	3.5	4.9	3.5	4.8	4.7
266	Bar iron: from store, Phila.	4.1	6.6	4.0	9.6	4.8	5.9	4.9
293	Copper: ingot	5.3	3.7	6.1	8.3	4.4	5.7	4.9
296	Lead: pig	5.2	3.2	4.7	9.1	8.7	5.9	5.0
300	Tin: pig	3.3	6.0	5.5	11.1	5.8	6.4	5.1
269	Nails: wire	7.7	6.6	3.0	4.6	3.2	5.2	5.4
267	Bar iron: from mill, Pittsburgh	4.1	8.3	5.8	12.2	4.3	7.2	5.8
302	Zinc: slab	4.5	6.4	6.0	12.2	8.1	7.3	6.0
259	Pig iron: basic	3.1	8.6	6.5	9.3	9.4	7.1	6.5
276	Steel billets	6.6	9.8	5.9	9.6	5.4	7.7	7.2
261	Pig iron: foundry No. 2, Northern	4.9	10.2	6.7	8.5	9.0	7.7	7.5
260	Pig iron: Bessemer	6.7	10.8	5.5	8.2	8.5	7.9	7.8
263	Pig iron: foundry No. 2, Southern	6.2	11.1	6.8	7.6	8.3	8.0	8.1
	Building materials							
308	Maple: N. Y.	.0	2.0	2.1	5.3	2.5	2.4	1.5
355	Zinc: oxide of	2.2	1.3	.9	4.9	3.7	2.4	1.8
319	Poplar: N. Y.	.7	3.1	1.6	5.3	1.6	2.6	1.8
312	Oak: white quartered, N. Y.	1.3	4.2	.6	6.6	.7	2.9	1.8
323	Shingles: cypress	.2	1.8	3.5	4.5	2.5	2.5	2.0
310	Oak: white plain, N. Y.	.6	2.7	2.9	6.0	1.9	2.9	2.0
313	Pine: white boards	1.4	3.2	1.3	3.7	3.1	2.5	2.1
354	Lead: carbonate of	1.9	2.7	1.8	4.6	2.7	2.7	2.2
317	Pine: yellow siding	2.0	3.7	2.2	8.9	4.4	4.2	2.8
321	Spruce	3.1	4.2	2.8	4.7	3.6	3.7	3.4
349	Putty	1.3	10.0	.2	3.8	1.3	3.5	3.4
324	Shingles: red cedar	1.0	1.7	6.4	10.7	7.8	5.3	3.7
338	Lime	6.3	4.2	1.8	7.1	1.5	4.5	3.7
335	Doors	3.3	7.4	3.7	6.4	6.3	5.3	5.0
345	Glass: window, B	6.8	7.7	5.4	5.9	3.3	6.1	6.2
344	Glass: window, A	6.6	7.7	5.1	5.4	5.1	6.1	6.3
348	Linseed oil	7.9	8.3	5.5	9.8	5.9	7.7	7.1
327	Brick	6.5	6.3	9.5	8.9	8.2	7.9	7.5
350	Rosin	6.7	5.9	8.8	15.0	11.7	9.4	7.8
352	Tar[2]	9.9	7.7	8.2	10.1	5.2	8.6	8.2
353	Turpentine: spirits of	5.1	7.8	11.7	14.6	12.9	10.1	8.9
	Chemicals and drugs							
363	Alum	2.4	.5	.0	10.1	.7	3.0	.9
393	Alcohol: grain	2.2	1.2	.8	4.5	.3	2.0	1.3
360	Acid: sulphuric	5.2	3.0	.5	12.1	2.8	4.9	2.9
357	Acid: muriatic	5.9	3.2	.2	10.4	2.7	4.7	3.0
381	Sulphur	6.3	2.8	.8	7.8	1.7	4.1	3.1
377	Soda: bicarbonate of	6.1	3.8	1.1	7.2	2.7	4.3	3.5
396	Glycerine	2.8	2.7	6.1	13.1	6.2	6.2	4.2
382	Tallow	5.1	5.3	4.4	10.9	7.0	6.5	5.2
362	Alcohol: wood	6.5	4.8	1.6	10.4	12.8	6.6	5.5

TABLE IV (Conc.)

(1) Ref. No.	(2) Commodity	(3) 1890–1897	(4) 1898–1905	(5) 1906–1913	(6) 1914–1921	(7) 1922–1925	(8) 1890–1925 inclusive	(9) 1890 1925 excluding 1914–1921
	Chemicals and drugs (cont.)							
400	Quinine	7.3	7.8	4.8	8.7	2.2	6.6	6.0
397	Opium	8.1	4.6	11.2	15.7	7.0	9.6	7.8
	House-furnishings							
428	Plates	1.1	.4	.1	5.8	.0	1.7	.5
429	Teacups and saucers	1.2	.3	.2	5.9	.0	1.7	.5
419	Carpets: Wilton	.4	.4	1.1	6.3	1.8	2.0	.8
418	Carpets: Brussels	.9	.3	1.0	6.4	1.8	2.1	.9
426	Pitchers	.0	.0	3.0	4.2	.9	1.7	1.0
414	Kitchen tables	.0	.6	1.2	5.5	3.7	2.0	1.0
406	Bedroom sets	.0	.6	1.4	7.9	3.3	2.6	1.0
425	Nappies	.0	.0	1.9	4.2	3.9	1.8	1.1
405	Bedroom chairs	.0	1.7	1.2	5.6	2.1	2.1	1.1
427	Tumblers	.0	.3	2.6	4.9	2.6	2.0	1.2
412	Kitchen chairs	.0	1.8	1.8	5.9	1.8	2.3	1.3
424	Sheeting: 10-4 Wamsutta	1.6	1.5	3.4	6.6	.6	3.0	1.9
417	Carpets: Axminster	1.7	2.5	1.2	6.1	3.2	2.9	2.0
430	Tickings: Amoskeag	2.2	3.9	3.7	9.1	3.7	4.6	3.4
423	Sheeting: 10-4 Pepperell	4.6	4.2	4.2	8.1	4.1	5.2	4.3
	Miscellaneous							
457	Tobacco: smoking	.0	1.2	.2	2.1	.7	.8	.5
456	Tobacco: plug	1.8	2.0	.2	2.8	.0	1.5	1.2
444	Paper: wrapping, Manila	1.2	4.4	1.2	8.3	5.3	3.9	2.7
440	Leather: sole oak	4.5	2.2	1.8	5.6	1.9	3.4	2.7
441	Leather: sole oak, scoured backs	3.2	2.8	1.8	4.7	3.9	3.2	2.8
438	Leather: harness oak	4.1	3.3	1.7	5.2	2.5	3.5	3.0
436	Leather: calf	5.3	1.7	2.2	11.4	2.7	4.9	3.0
443	Paper: newsprint	2.7	4.6	4.5	5.8	1.4	4.0	3.6
433	Cottonseed meal	3.9	2.7	3.4	8.4	5.6	4.7	3.7
455	Starch: laundry	4.9	4.0	4.4	6.5	1.2	4.5	4.0
450	Rope	5.0	9.1	5.1	5.6	5.3	6.1	6.3
448	Jute	8.1	5.0	8.8	10.2	14.0	8.7	8.2
451	Rubber	5.3	3.9	10.9	10.1	17.7	8.7	8.3

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[1] Prices for 1918 missing (no quotations).

[2] Prices for 1925 missing.

[3] Prices for 1919 missing (no quotations).

[4] Prices for 1901 missing (no sales during year).

[5] Prices for 1890, 1891, 1892 missing (records destroyed).

[6] Prices for 1924, 1925 missing.

TABLE V

MEASURES OF MONTHLY VARIABILITY OF COMMODITY PRICES, AT WHOLESALE 1890-1925

Crop Year Measures
Averages, by Periods

(1) Ref. No.	(2) Commodity	(3) 1890–91 to 1897–98	(4) 1898–99 to 1904–05	(5) 1905–06 to 1912–13	(6) 1913–14 to 1920–21	(7) 1921–22 to 1924–25	(8) 1890–91 to 1924–25, inclusive	(9) 1890–91 to 1924–25, excluding 1913–14 to 1920–21
1	Barley	5.9	4.5	8.3	10.5	5.3	7.1	6.2
2	Corn	9.0	7.4	9.3	10.8	10.7	9.3	8.9
4	Oats	6.9	6.3	7.7	10.1	6.1	7.6	6.9
5	Rye	8.1	5.3	5.5	10.7	9.4	7.7	6.8
6	Wheat	6.8	4.2	5.5	10.3	5.4	6.6	5.5
22	Beans	7.3	6.7	5.4	9.1	10.9	7.6	7.1
25	Cotton	6.5	10.1	5.7	11.3	7.3	8.2	7.3
31	Eggs	22.6	22.2	23.1	21.9	24.9	22.7	23.0
34	Flaxseed	6.5	8.8	6.4	10.7	8.3	8.1	7.3
37	Hay	5.8	5.2	8.0	10.9	4.4	7.2	6.1
44	Hops	14.3	11.6	17.0	26.1	12.5	16.8	14.1
49	Onions	22.1	24.5	23.9	29.0	30.0	25.5	24.4
51	Potatoes	9.0	15.5	13.6	20.0	13.5	14.4	12.7
53	Rice	4.1	3.3	3.1	9.2	6.2	5.1	3.9
117	Flour: rye	8.9	5.1	4.3	11.2	8.3	7.5	6.5
119	Flour: wheat, winter straights	6.0	4.3	6.3	10.1	5.1	6.6	5.5
120	Flour: wheat, standard patents	4.5	3.4	4.8	9.9	5.2	5.7	4.4
128	Apples	15.8	9.1	13.6	15.4	12.5	13.5	12.9
158	Cottonseed oil	8.4	7.7	10.1	10.8	8.0	9.1	8.6

TABLE VI

Measures of Monthly Variability of the Prices of Farm Products and Foods, at Wholesale

Averages for the Period 1890-1925 (excluding 1914-1921)[1]

(Commodities arranged within each group in order of magnitude of the measures of price variability)

(1) Ref. No.	(2) Commodity	(3) Measure of price variability
	Farm products	
53	Rice	3.9 (3.7)
56	Wool: fine clothing	4.4
59	Wool: medium	4.9
14	Cattle: good to choice	5.0
6	Wheat	5.5 (6.8)
13	Cattle: choice to prime	5.6
37	Hay	6.1 (7.0)
1	Barley	6.1 (9.0)
5	Rye	6.8 (8.7)
4	Oats	6.9 (14.0)
22	Beans	7.1 (7.2)
25	Cotton	7.3 (8.1)
34	Flaxseed	7.3 (7.7)
15	Hogs: heavy	7.8
16	Hogs: light	7.9
42	Hides	8.7
2	Corn	8.9 (10.3)
19	Sheep: wethers	11.5
17	Sheep: ewes	12.5
47	Milk	12.6
51	Potatoes	12.7 (26.4)
44	Hops	14.1 (19.8)
31	Eggs	23.0 (23.1)
49	Onions	24.4 (28.4)
	Foods	
104	Bread: Cincinnati	.3
106	Bread: N. Y.	.8
111	Crackers: oyster	1.2
148	Starch: corn	1.5
112	Crackers: soda	1.6
161	Vinegar	3.0
141	Molasses	3.1
116	Salmon	3.2
152	Tea	3.2
113	Cod	4.4
120	Flour: wheat, standard patents	4.4 (6.2)
64	Beef: fresh	5.0
119	Flour: wheat, winter straights	5.5 (6.2)
150	Sugar: granulated	5.6
68	Beef: salt	5.7
145	Pepper	5.7
146	Salt	5.9
131	Raisins	6.1
69	Hams	6.2

TABLE VI (Cont.)

(1) Ref. No.	(2) Commodity	(3) Measure of price variability
	Foods (cont.)	
114	Herring[2]	6.2
138	Lard	6.4
117	Flour: rye	6.4 (7.3)
109	Coffee	6.7
140	Meal: corn, yellow table	6.8
139	Meal: corn, fine white	6.8
74	Pork: cured, salt mess	6.9
149	Sugar: raw	7.1
76	Pork: cured, short clear sides	7.7
75	Pork: cured, rough sides	7.8
158	Cottonseed oil	8.6 (7.1)
129	Currants	8.8
115	Mackerel	8.8
130	Prunes	9.0
99	Cheese	9.4
90	Butter: creamery firsts, N. Y.	9.7
71	Mutton	9.7
89	Butter: creamery extra, N. Y.	11.1
95	Butter: creamery extra, St. Louis	11.2
128	Apples	12.9 (11.4)

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[1] Where but one measure is given for a single commodity it relates to variability within the calendar year. Where two are given the first is based upon crop year prices, the second (in parenthesis) upon calendar year prices. The ranking is based upon the crop year measures in such cases.
This table supplements Table IV. It seems proper to present farm products and foods in another ranking, in which the disturbing effects of crop changes shall have been to some extent eliminated.

[2] Prices for 1925 missing.

TABLE VII

MEASURES OF YEAR-TO-YEAR VARIABILITY OF COMMODITY PRICES, AT WHOLESALE[1]
(Commodities arranged within each group in order of magnitude of the measures in column 3.)

(1) Ref. No.	(2) Commodity	(3) Measure of price variability 1890–1913	(4) Measure of price variability 1890-1924
	Farm products		
47	Milk	3.8	3.0
31	Eggs	6.0 (6.2)	8.6 (8.3)
14	Cattle: good to choice	7.9	9.8
53	Rice	8.2 (8.1)	12.0 (11.9)
56	Wool: fine clothing	8.8	14.3
59	Wool: medium	8.9	15.3
13	Cattle: choice to prime	9.1	10.5
19	Sheep: wethers	10.7	12.9
17	Sheep: ewes	10.8	14.6
6	Wheat	12.8 (11.7)	16.8 (13.9)
42	Hides	12.9	15.2
37	Hay	13.2 (12.6)	14.1 (12.3)
15	Hogs: heavy	13.8	16.1
22	Beans	13.9 (14.1)	18.2 (18.9)
16	Hogs: light	13.9	16.0
5	Rye	14.6 (14.4)	20.2 (18.1)
2	Corn	14.8 (15.4)	17.6 (17.6)
25	Cotton	16.2 (14.2)	20.4 (18.2)
1	Barley	17.8 (16.4)	20.6 (16.3)
34	Flaxseed	19.1 (16.4)	18.5 (17.9)
4	Oats	19.8 (16.1)	20.3 (16.6)
44	Hops	32.9 (24.3)	40.6 (31.2)
49	Onions	35.4 (15.8)	50.6 (32.3)
51	Potatoes	53.6 (34.5)	54.4 (39.4)
	Foods		
104	Bread: Cincinnati	1.7	5.4
106	Bread: N. Y.	2.9	5.5
148	Starch: corn	3.8	5.4
111	Crackers: oyster	4.5	8.3
112	Crackers: soda	4.7	8.2
71	Mutton: dressed	5.6	10.4
152	Tea	6.2	7.6
95	Butter: creamery extra, St. Louis	6.5	8.8
161	Vinegar	6.7	12.4
116	Salmon	6.8	8.8
89	Butter: creamery extra, N. Y.	7.4	9.3
150	Sugar: granulated	7.9	11.8
64	Beef: fresh	8.0	8.8
113	Cod	8.2	8.0
99	Cheese	8.3	10.8
149	Sugar: raw	9.4	14.2
90	Butter: creamery firsts, N. Y.	9.4	10.9

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[1] Where but one measure is given for a single commodity, it relates to calendar year variability. Where two are given, the first is based upon crop year prices, the second (in parenthesis) upon calendar year prices. The ranking is based upon the crop year measures in such cases.

TABLE VII (Cont.)

(1) Ref. No.	(2) Commodity	(3) Measure of price variability 1890–1913	(4) Measure of price variability 1890–1924
	Foods (cont.)		
114	Herring	10.3	11.4
117	Flour: rye	10.3 (12.4)	17.2 (16.4)
69	Hams	10.4	11.7
146	Salt	10.4	11.0
141	Molasses	10.5	12.7
120	Flour: wheat, standard patents	11.2 (9.2)	15.5 (12.3)
139	Meal: corn, fine white	12.1	17.1
119	Flour: wheat, winter straights	12.7 (13.1)	16.7 (15.0)
140	Meal: corn, yellow table	13.0	16.9
145	Pepper	13.4	14.8
130	Prunes	13.7	19.7
68	Beef: salt	14.2	14.8
138	Lard	15.4	17.3
76	Pork: cured, short clear sides	15.4	16.9
75	Pork: cured, rough sides	15.8	16.9
115	Mackerel	15.9	17.0
131	Raisins	15.9	19.9
74	Pork: cured, salt mess	16.1	17.2
158	Cottonseed oil	16.1 (17.7)	19.2 (20.4)
109	Coffee	17.3	20.5
129	Currants	20.0	20.3
128	Apples	22.4 (22.2)	22.5(26.5)
	Cloths and clothing		
223	Linen shoe thread	1.1	6.1
166	Men's shoes: black calf	1.6	6.3
213	Underwear: shirts and drawers	2.2	5.3
214	Underwear: union suits	2.6	10.7
199	Cotton thread	2.6	8.7
218	Poplar cloth	2.6	8.1
174	Men's shoes: vici kid	2.8	6.8
219	Sicilian cloth	2.8	8.2
177	Women's shoes	3.9	8.1
210	Suitings: Middlesex	4.7	9.1
173	Men's shoes: chocolate elk	4.7	6.7
206	Flannels: white	5.0	7.6
215	Broadcloth	5.2	9.0
193	Muslin: Wamsutta	5.2	11.4
187	Men's hosiery	5.4	9.5
189	Women's hosiery	5.5	9.4
192	Muslin: Rough Rider	5.7	11.7
197	Sheetings: 4-4 Pepperell R	5.9	12.0
191	Muslin: Lonsdale	6.0	12.0
217	Storm serge	6.1	10.8
186	Ginghams: Lancaster	6.2	11.6
196	Sheetings: 4-4 Indian Head	6.4	13.2
181	Drillings: Pepperell	6.6	13.0
179	Calico	6.7	12.1
198	Sheetings: 4-4 Ware Shoals	7.0	14.6
190	Muslin: Fruit of the Loom	7.0	13.0
180	Denims	7.1	13.1

TABLE VII (Cont.)

(1) Ref. No.	(2) Commodity	(3) Measure of price variability 1890–1913	(4) Measure of price variability 1890–1924
	Cloths and clothing (cont).		
221	Worsted yarns: 2-40's	7.1	11.8
182	Drillings: Mass. D.	7.2	13.8
184	Flannel: unbleached	7.2	15.4
185	Ginghams: Amoskeag	7.4	11.8
216	French serge	7.8	11.6
183	Flannel: colored	8.5	17.1
220	Worsted yarns: 2-32's	8.6	13.8
203	Cotton yarns: carded, cones 22/1	8.7	14.9
202	Cotton yarns: carded, cones 10/1	9.9	16.2
226	Silk: raw, Japanese Kansai No. 1	10.4	13.3
228	Silk: raw, Japanese extra-extra	11.5	14.6
195	Print cloths	11.7	17.9
	Fuel and lighting		
224	Matches	2.2	4.0
232	Anthracite coal: broken	3.0	5.1
235	Anthracite coal: stove	4.9	5.8
234	Anthracite coal: egg	5.3	5.7
233	Anthracite coal: chestnut	5.4	5.5
236	Bituminous coal: Kanawha	7.2	12.3
238	Bituminous coal: Pocahontas	7.4	10.5
249	Petroleum: refined 150° fire test	10.0	10.5
248	Petroleum: refined for export	10.2	12.6
237	Bituminous coal: New River	10.5	13.7
247	Petroleum: crude	19.4	20.8
239	Coke	21.2	36.3
	Metals and metal products		
287	Trowels	.2	4.0
272	Saws: crosscut	1.0	5.2
273	Saws: hand	1.0	4.6
255	Hammers	2.5	6.6
274	Shovels	2.8	5.9
254	Files	3.1	6.0
271	Planes	3.5	8.0
251	Butts	5.9	11.9
298	Quicksilver	6.1	13.4
299	Silver	6.6	9.4
297	Lead: pipe	7.0	12.5
288	Vises	7.1	10.6
296	Lead: pig	7.3	14.1
280	Steel rails	7.8	9.7
252	Chisels	9.0	10.2
250	Augers	9.1	12.8
301	Zinc: sheet	9.2	14.7
289	Wire: fence	9.7	11.4
258	Locks	10.0	13.1
253	Door knobs	10.3	12.0
266	Bar iron: from store, Phila.	10.8	16.0
294	Copper: sheet	11.7	13.3
302	Zinc: slab	11.9	17.8
295	Copper: wire	12.0	14.8

TABLE VII (Cont.)

(1) Ref. No.	(2) Commodity	(3) Measure of price variability 1890–1913	(4) Measure of price variability 1890–1924
	Metals and metal products (cont.)		
300	Tin: pig	12.9	16.2
267	Bar iron: from mill, Pittsburgh	13.3	19.3
293	Copper: ingot	13.3	15.2
259	Pig iron: basic	13.5	19.3
269	Nails: wire	13.8	15.3
260	Pig iron: Bessemer	15.5	19.8
276	Steel billets	15.6	21.3
261	Pig iron: foundry No. 2 Northern	16.2	20.3
263	Pig iron: foundry No. 2 Southern	16.8	20.7
291	Wood screws	17.8	20.3
	Building materials		
308	Maple, N.Y.	3.0	9.9
355	Zinc: oxide of	4.1	6.5
312	Oak: white, quartered, N. Y.	4.3	9.9
310	Oak: white, plain, N. Y.	4.6	9.9
354	Lead: carbonate of	5.1	7.5
338	Lime	5.4	8.4
319	Poplar: N. Y.	5.8	10.3
317	Pine: yellow siding	5.8	11.9
313	Pine: white boards	6.5	9.6
324	Shingles: red cedar	6.6	11.6
323	Shingles: cypress	7.0	9.9
349	Putty	7.3	8.3
321	Spruce	7.3	9.6
335	Doors	10.0	13.6
327	Brick	10.3	13.9
352	Tar	10.6	13.6
343	Glass: plate, 5-10 sq. ft.	12.5	14.9
345	Glass: window, B	13.0	14.8
353	Turpentine: spirits of	13.5	19.6
344	Glass: window, A	13.6	14.6
342	Glass: plate, 3-5 sq. ft.	13.8	17.5
350	Rosin	15.1	18.3
348	Linseed oil	16.9	19.0
	Chemicals and drugs		
363	Alum	2.1	6.9
393	Alcohol: grain	2.3	5.2
360	Acid: sulphuric	7.0	10.8
381	Sulphur	7.5	10.3
357	Acid: muratic	9.0	14.0
377	Soda: bicarbonate of	9.9	12.0
362	Alcohol: wood	11.2	19.8
382	Tallow	11.5	14.5
396	Glycerine	11.6	16.1
400	Quinine	13.1	16.6
397	Opium	16.4	21.7
	House-furnishings		
429	Teacups and saucers	2.3	7.3
420	Carvers	2.4	6.6
428	Plates	2.5	7.0

TABLE VII (Conc.)

(1) Ref. No.	(2) Commodity	(3) Measure of price variability 1890–1913	(4) Measure of price variability 1890–1924
	House-furnishings (cont.)		
419	Carpets: Wilton	2.8	6.7
431	Tubs	3.1	11.2
418	Carpets: Brussels	3.1	7.8
414	Kitchen: tables	3.4	9.2
425	Nappies	3.5	8.0
417	Carpets: Axminster	4.9	8.4
415	Blankets: cotton	5.2	11.9
426	Pitchers	5.2	8.6
416	Blankets: woolen	5.3	9.1
421	Knives and forks	5.9	8.6
412	Kitchen: chairs	6.0	10.9
424	Sheeting: 10-4 Wamsutta	6.0	10.6
406	Bedroom: sets	6.3	11.2
422	Pails	6.3	11.9
427	Tumblers	6.7	11.4
430	Tickings: Amoskeag	6.9	14.9
423	Sheeting: 10-4 Pepperell	7.1	11.2
405	Bedroom: chairs	7.4	10.4
	Miscellaneous		
457	Tobacco: smoking	1.7	4.0
456	Tobacco: plug	3.0	6.2
444	Paper: wrapping, Manila	3.3	8.3
441	Leather: sole oak, scoured backs	5.0	7.8
436	Leather: calf	5.8	10.6
438	Leather: harness oak	5.9	7.6
440	Leather: sole oak	5.9	7.9
433	Cottonseed meal	7.1	9.7
443	Paper: newsprint	8.3	10.9
455	Starch: laundry	8.7	10.8
448	Jute	15.3	17.5
450	Rope	15.3	16.4
451	Rubber	15.9	16.6

TABLE VIII

Measures of Price Variability

Indexes of Frequency of Change in Monthly Commodity Prices, at Wholesale, 1890-1925, by Periods

(Commodities arranged within each group in order of magnitude of the measures in column 9.)

(1) Ref. No.	(2) Commodity	(3) 1890–1897	(4) 1898–1905	(5) 1906–1913	(6) 1914–1921	(7) 1922–1925	(8) 1890–1925 inclusive	(9) 1890–1925 excluding 1914–1921
	Farm products							
53	Rice	.31	.41	.36	.70	.79	.48	.42
59	Wool: medium	.56	.57	.41	.64	.73	.57	.54
56	Wool: fine clothing	.55	.56	.38	.62	.85	.57	.55
44	Hops	.94	.68	.75	.78	.73	.78	.78
47	Milk	.77	.92	.87	.87	.62	.83	.82
49	Onions	.91	.95	.85	.96	1.00	.93	.92
42	Hides	.89	1.00	.88	.92	.96	.93	.93
22	Beans	.93	.92	.93	.97	1.00	.94	.93
37	Hay	.98	.96	1.00	1.00	1.00	.99	.98
25	Cotton	.98	.98	1.00	1.00	1.00	.99	.99
34	Flaxseed	1.00	.98	.99	1.00	1.00	.99	.99
1	Barley	.98	1.00	1.00	.99	1.00	.99	.99
5	Rye	.98	1.00	1.00	1.00	1.00	.99	.99
13	Cattle: choice to prime	.98	1.00	1.00	.99	1.00	.99	.99
14	Cattle: good to choice	.99	.99	1.00	1.00	1.00	.99	.99
51	Potatoes	1.00	.99	1.00	.99	1.00	.99	1.00
2	Corn	1.00	1.00	.99	.98	1.00	.99	1.00
4	Oats	1.00	1.00	.99	1.00	1.00	1.00	1.00
31	Eggs	1.00	.99	1.00	1.00	1.00	1.00	1.00
6	Wheat	1.00	1.00	1.00	.91	1.00	.98	1.00
15	Hogs: heavy	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	Hogs: light	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Sheep: ewes	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Sheep: wethers	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Foods							
104	Bread: Cincinnati	.04	.03	.02	.14	.02	.05	.03
106	Bread: N. Y.	.02	.03	.02	.48	.10	.13	.03
111	Crackers: oyster	.06	.08	.02	.21	.02	.08	.05
112	Crackers: soda	.08	.13	.02	.21	.02	.10	.07
148	Starch: corn	.07	.14	.05	.22	.02	.11	.08
161	Vinegar	.05	.09	.13	.41	.21	.18	.11
152	Tea	.23	.26	.10	.26	.17	.21	.19
116	Salmon	.19	.28	.15	.68	.56	.35	.26
141	Molasses	.33	.34	.11	.23	.27	.25	.26
113	Cod	.48	.31	.20	.41	.44	.36	.35
114	Herring	.60	.41	.26	.44	.07	.40	.39
146	Salt	.36	.52	.45	.24	.14	.36	.40
131	Raisins	.75	.60	.27	.43	.44	.51	.53
115	Mackerel	.73	.57	.55	.53	.44	.57	.58
130	Prunes	.75	.61	.66	.79	.98	.73	.71

TABLE VIII (Cont.)

(1) Ref. No.	(2) Commodity	(3) 1890–1897	(4) 1898–1905	(5) 1906–1913	(6) 1914–1921	(7) 1922–1925	(8) 1890–1925, inclusive	(9) 1890–1925, excluding 1914–1921
	Foods (cont.)							
150	Sugar: granulated	.76	.61	.67	.73	1.00	.73	.72
129	Currants	.90	.84	.52	.62	.67	.72	.74
68	Beef: salt	.87	.81	.68	.54	.62	.71	.76
149	Sugar: raw	.69	.79	.74	.70	1.00	.76	.78
139	Meal: corn, fine white	.94	.78	.57	.84	.98	.80	.79
140	Meal: corn, yellow table	.97	.78	.60	.83	.94	.81	.81
128	Apples	.87	.79	.84	.84	.87	.84	.84
145	Pepper	.85	.87	.81	.97	.87	.88	.85
117	Flour: rye	.87	.88	.77	.89	.98	.87	.86
158	Cottonseed oil	.81	.96	.98	1.00	1.00	.94	.93
109	Coffee	.97	.88	.92	.95	.98	.93	.93
64	Beef: fresh	.96	.98	.93	.99	.98	.96	.96
69	Hams	.94	.98	.98	.98	.98	.97	.97
75	Pork: cured, rough sides	.99	.98	.98	1.00	.89	.98	.97
99	Cheese	.99	.95	.97	1.00	1.00	.98	.97
71	Mutton	.97	.97	1.00	1.00	.98	.98	.98
119	Flour: wheat, winter straights	.99	.97	.99	.95	.98	.97	.98
74	Pork: cured, salt mess	.99	.99	.99	.97	.98	.98	.99
138	Lard	.99	.99	.98	1.00	1.00	.99	.99
89	Butter: creamery extra, N. Y.	.99	.99	1.00	1.00	.98	.99	.99
95	Butter: creamery extra, St. Louis	1.00	.97	1.00	.99	1.00	.99	.99
76	Pork: cured, short clear sides	1.00	1.00	.99	1.00	.98	.99	.99
90	Butter: creamery firsts, N. Y.	.98	1.00	1.00	1.00	1.00	.99	.99
120	Flour: wheat, standard patents	1.00	.98	1.00	1.00	1.00	.99	.99
	Cloths and clothing							
213	Underwear: shirts and drawers	.02	.01	.01	.10	.06	.04	.02
199	Cotton thread	.02	.01	.03	.17	.04	.05	.02
214	Underwear: union suits	.03	.04	.01	.17	.04	.06	.03
223	Linen shoe thread	.02	.05	.00	.21	.06	.07	.03
218	Poplar cloth	.04	.08	.04	.21	.06	.09	.06
174	Men's shoes: vici kid	.02	.07	.10	.36	.04	.13	.05
166	Men's shoes: black calf	.00	.04	.10	.36	.23	.14	.07
219	Sicilian cloth	.03	.07	.09	.30	.12	.12	.07
210	Suiting: Middlesex	.04	.10	.08	.36	.19	.15	.09
215	Broadcloth	.03	.09	.12	.35	.19	.14	.10
216	French serge	.08	.10	.11	.32	.14	.15	.11
206	Flannels: white	.10	.14	.09	.18	.14	.13	.12
177	Women's shoes	.08	.11	.21	.48	.10	.21	.13
217	Storm serge	.11	.22	.08	.35	.09	.18	.13
193	Muslin: Wamsutta	.09	.14	.14	.41	.17	.19	.13
186	Ginghams: Lancaster	.15	.11	.21	.41	.11	.20	.15
179	Calico	.09	.08	.21	.40	.35	.21	.16
185	Ginghams: Amoskeag	.16	.20	.16	.27	.12	.19	.16
184	Flannel: unbleached	.05	.25	.19	.41	.32	.24	.18
183	Flannel: colored	.05	.28	.20	.44	.32	.25	.20
173	Men's shoes: chocolate elk	.29	.17	.36	.36	.19	.29	.26
196	Sheetings: 4-4 Indian Head	.26	.28	.27	.45	.37	.32	.29

TABLE VIII (Cont.)

(1) Ref. No.	(2) Commodity	(3) 1890–1897	(4) 1898–1905	(5) 1906–1913	(6) 1914–1921	(7) 1922–1925	(8) 1890–1925 inclusive	(9) 1890–1925 excluding 1914–1921
	Cloths and clothing (cont.)							
181	Drillings: Pepperell	.34	.24	.18	.59	.67	.37	37
190	Muslin: Fruit of the Loom	.26	.36	.33	.48	.33	.36	.32
180	Denims	.17	.34	.28	.48	.81	.37	.34
197	Sheetings: 4-4 Pepperell R	.36	.30	.25	.64	.61	.40	.34
191	Muslin: Lonsdale	.24	.47	.35	.52	.50	.41	.38
220	Worsted yarns: 2-32's	.37	.36	.31	.53	.67	.42	.39
192	Muslin: Rough Rider	.15	.47	.34	.67	.87	.46	.40
221	Worsted yarns: 2-40's	.29	.49	.31	.74	.71	.49	.41
198	Sheetings: 4-4 Ware Shoals	.94	.61	.53	.80	.96	.75	.74
202	Cotton yarns: carded, cones 10/1	.66	.72	.71	.91	.98	.78	.74
203	Cotton yarns: carded, cones 22/1	.80	.68	.79	.88	.98	.81	.79
228	Silk: raw, Japanese extra-extra	.69	.78	.85	.85	.98	.82	.81
226	Silk: raw, Japanese Kansai No. 1	.78	.93	.85	.91	.98	.88	.87
182	Drillings: Mass. D	.97	.98	.67	.73	.94	.84	.88
195	Print cloths	.93	.87	.81	.93	.94	.89	.88
	Fuel and lighting							
244	Matches	.03	.01	.00	.05	.02	.02	.01
237	Bituminous coal: New River	.17	.31	.41	.33	.44	.32	.32
249	Petroleum: refined, 150° fire test	.37	.22	.10	.29	.87	.31	.32
238	Bituminous coal: Pocahontas	.21	.28	.48	.26	.62	.34	.37
236	Bituminous coal: Kanawha	.71	.37	.25	.27	.37	.38	.41
248	Petroleum: refined, for export	.64	.68	.27	.56	.48	.53	.52
247	Petroleum: crude	.97	.41	.24	.46	.73	.54	.56
239	Coke	.38	.60	.92	.72	.98	.69	.68
232	Anthracite coal: broken	.96	.98	.58	.93	.72	.85	.82
235	Anthracite coal: stove	.96	.93	.88	.94	.88	.92	.92
234	Anthracite coal: egg	.99	.90	.84	.93	1.00	.92	.92
233	Anthracite coal: chestnut	.95	.93	.89	.95	.98	.93	.93
	Metals and metal products							
272	Saws: crosscut	.00	.00	.01	.10	.02	.03	.01
287	Trowels	.00	.00	.01	.04	.02	.01	.01
273	Saws: hand	.01	.00	.01	.12	.02	.03	.01
271	Planes	.03	.04	.05	.13	.00	.06	.03
255	Hammers	.01	.05	.02	.09	.10	.05	.04
250	Augers	.05	.08	.07	.20	.00	.09	.06
252	Chisels	.06	.09	.08	.14	.04	.08	.07
274	Shovels	.02	.05	.07	.20	.19	.10	.07
253	Door knobs	.02	.07	.06	.16	.19	.09	.07
258	Locks	.03	.05	.07	.19	.19	.10	.07
251	Butts	.11	.05	.04	.14	.21	.10	.09
288	Vises	.07	.11	.08	.19	.17	.12	.10
254	Files	.08	.10	.20	.18	.04	.13	.12
280	Steel rails	.23	.18	.00	.14	.04	.13	.12
291	Wood screws	.11	.52	.08	.30	.35	.27	.26
294	Copper: sheet	.35	.14	.29	.67	.87	.44	.35
297	Lead: pipe	.21	.38	.47	.72	.85	.49	.43
301	Zinc: sheet	.24	.34	.48	.48	.85	.44	.43

TABLE VIII (Cont.)

(1) Ref. No.	(2) Commodity	(3) 1890–1897	(4) 1898–1905	(5) 1906–1913	(6) 1914–1921	(7) 1922–1925	(8) 1890–1925 inclusive	(9) 1890 1925 excluding 1914–1921
	Metals and metal products (cont.)							
269	Nails: wire	.75	.37	.28	.52	.46	.48	.46
267	Bar iron: from mill, Pitts.	.39	.43	.62	.59	.39	.50	.47
266	Bar iron: from store, Phila.	.61	.50	.31	.59	.54	.51	.48
289	Wire fence	.69	.52	.32	.54	.46	.51	.50
298	Quicksilver	.66	.50	.50	.72	.94	.63	.61
295	Copper: wire	.68	.67	.52	.72	.81	.66	.64
263	Pig iron: foundry No. 2 Southern	.64	.81	.69	.70	.85	.73	.73
259	Pig iron: basic	.61	.84	.79	.68	.92	.75	.77
296	Lead: pig	.98	.58	.78	.86	.94	.82	.80
276	Steel billets	.99	.82	.68	.69	.69	.78	.81
261	Pig iron: foundry No. 2 Northern	.75	.87	.83	.70	.92	.80	.83
260	Pig iron: Bessemer	.98	.92	.78	.63	.87	.83	.89
293	Copper: ingot	.90	.82	.94	.84	.94	.88	.89
302	Zinc: slab	.96	.93	.96	.99	1.00	.96	.95
300	Tin: pig	.98	.99	.96	.95	1.00	.97	.98
299	Silver	1.00	1.00	1.00	.97	.98	.99	.99
	Building materials							
349	Putty	.04	.11	.02	.11	.04	.07	.06
308	Maple: N. Y.	.00	.16	.09	.23	.19	.13	.10
355	Zinc: oxide of	.14	.08	.05	.18	.23	.12	.11
312	Oak: white quartred, N. Y.	.09	.23	.12	.24	.14	.17	.15
313	Pine: white boards	.08	.14	.15	.29	.29	.18	.15
323	Shingles: cypress	.07	.08	.37	.32	.12	.20	.17
310	Oak: white plain, N. Y.	.06	.20	.31	.36	.27	.23	.20
319	Poplar: N. Y.	.07	.24	.25	.37	.27	.24	.20
317	Pine: yellow siding	.11	.12	.10	.36	.83	.25	.22
354	Lead: carbonate of	.25	.22	.19	.36	.54	.29	.26
321	Spruce	.25	.18	.14	.33	.83	.29	.28
345	Glass: window, B	.29	.38	.25	.17	.17	.26	.29
344	Glass: window, A	.29	.39	.25	.15	.17	.26	.29
335	Doors	.35	.28	.27	.42	.35	.33	.30
324	Shingles: red cedar	.09	.09	.71	.81	.94	.48	.39
338	Lime	.48	.37	.10	.39	.98	.41	.41
352	Tar	.80	.61	.41	.61	.11	.58	.57
327	Brick	.45	.60	.77	.70	.62	.63	.61
348	Linseed oil	.51	.64	.72	.96	1.00	.74	.68
350	Rosin	.84	.80	.97	.95	.98	.90	.89
353	Turpentine: spirits of	.94	.98	.98	1.00	1.00	.98	.97
	Chemicals and drugs							
357	Acid: muriatic	.18	.05	.02	.37	.14	.15	.09
363	Alum	.29	.05	.00	.38	.10	.17	.11
377	Soda: bicarbonate of	.19	.12	.02	.39	.14	.18	.12
360	Acid: sulphuric	.18	.12	.04	.27	.25	.16	.13
362	Alcohol	.17	.10	.09	.46	.39	.23	.16
400	Quinine	.29	.59	.20	.24	.06	.30	.32
393	Alcohol: grain	.54	.47	.28	.43	.21	.40	.40
396	Glycerine	.22	.29	.70	.84	.62	.53	.43

TABLE VIII (Conc.)

(1) Ref. No.	(2) Commodity	(3) 1890–1897	(4) 1998–1905	(5) 1996–1913	(6) 1914–1921	(7) 1922–1925	(8) 1890–1925 inclusive	(9) 1890–1925 excluding 1924–1921
	Chemicals and drugs (cont.)							
381	Sulphur	.80	.74	.05	.17	.14	.41	.47
397	Opium	.90	.88	.86	.65	.25	.76	.79
382	Tallow	.99	.97	.94	.93	.94	.95	.96
	House-furnishings							
425	Nappies	.01	.01	.06	.17	.06	.06	.03
414	Kitchen tables	.02	.02	.05	.22	.14	.08	.05
428	Plates	.03	.07	.05	.13	.04	.07	.05
426	Pitchers	.01	.03	.08	.17	.12	.08	.05
429	Teacups and saucers	.03	.07	.06	.13	.04	.07	.05
405	Bedroom chairs	.03	.07	.06	.22	.08	.09	.06
412	Kitchen chairs	.02	.09	.05	.25	.10	.10	.06
418	Carpets: Brussels	.05	.04	.07	.30	.14	.12	.07
419	Carpets: Wilton	.04	.05	.07	.28	.17	.12	.07
427	Tumblers	.05	.08	.07	.19	.14	.10	.08
406	Bedroom sets	.03	.05	.09	.31	.25	.14	.09
424	Sheeting: 10-4 Wamsutta	.07	.06	.14	.34	.09	.15	.09
417	Carpets: Axminster	.09	.11	.06	.27	.17	.14	.10
430	Tickings: Amoskeag	.19	.30	.24	.43	.21	.28	.24
423	Sheeting: 10-4 Pepperell	.34	.26	.23	.50	.56	.35	.31
	Miscellaneous							
457	Tobacco: smoking	.00	.04	.03	.06	.02	.03	.02
456	Tobacco: plug	.18	.10	.02	.06	.02	.08	.09
444	Paper: wrapping, Manila	.14	.19	.07	.35	.39	.21	.17
455	Starch: laundry	.23	.22	.27	.31	.06	.23	.21
436	Leather: calf	.32	.14	.27	.54	.31	.32	.25
438	Leather: harness oak	.24	.28	.24	.47	.37	.31	.27
440	Leather: sole oak	.45	.24	.19	.48	.14	.32	.27
443	Paper: newsprint	.27	.45	.33	.42	.29	.36	.34
441	Leather: sole oak, scoured backs	.37	.56	.43	.44	.54	.46	.46
450	Rope	.46	.62	.37	.41	.39	.46	.47
448	Jute	.48	.45	.80	.75	.79	.64	.61
433	Cottonseed meal	.69	.61	.76	.77	.83	.72	.71
451	Rubber	.93	.95	.95	.87	.98	.93	.95

TABLE IX

AVERAGE ANNUAL RATES OF CHANGE IN PRICES AND PURCHASING POWER OF COMMODITIES, AT WHOLESALE, 1896-1913

(Commodities arranged within each group in order of magnitude of measures of change)

(1) Ref. No.	(2) Commodity	(3) Average annual rate of change in price, 1896–1913 Per cent	(4) Average annual rate of change in purchasing power, 1896-1913 Per cent
	Farm products		
53	Rice	— .15	—2.4
49	Onions	.01	—2.3
59	Wool: medium	.9	—1.4
17	Sheep: ewes	1.2	—1.1
56	Wool: fine clothing	1.6	— .8
19	Sheep: wethers	1.6	— .7
47	Milk	2.4	.03
6	Wheat	2.6	.2
13	Cattle: choice to prime	3.1	.8
14	Cattle: good to choice	3.2	.8
42	Hides	3.4	1.0
34	Flaxseed	3.6	1.2
22	Beans	3.9	1.5
25	Cotton	3.9	1.5
31	Eggs	4.0	1.6
5	Rye	4.1	1.7
51	Potatoes	4.3	1.9
37	Hay	4.3	1.9
4	Oats	4.4	2.0
16	Hogs: light	4.5	2.1
15	Hogs: heavy	4.6	2.2
2	Corn	4.9	2.5
44	Hops	5.2	2.8
1	Barley	5.7	3.3
	Foods		
152	Tea	—1.4	—3.7
115	Mackerel	— .4	—2.6
112	Crackers: soda	— .2	—2.5
150	Sugar: granulated	.1	—2.2
149	Sugar: raw	.2	—2.1
145	Pepper	.4	—1.9
131	Raisins	.4	—1.9
104	Bread: Cincinnati	.6	—1.7
141	Molasses	1.4	— .9
119	Flour: wheat, winter straights	1.4	— .9
148	Starch: corn	1.6	— .8
120	Flour: wheat, standard patents	1.8	— .5
146	Salt	1.9	— .4
128	Apples	1.9	— .4
71	Mutton: dressed	2.1	— .2
161	Vinegar	2.1	— .2
106	Bread: N. Y.	2.1	— .2

TABLE IX (Cont.)

(1) Ref. No.	(2) Commodity	(3) Average annual rate of change in price, 1896–1913 Per cent	(4) Average annual rate of change in purchasing power, 1896–1913 Per cent
	Foods (cont.)		
111	Crackers: oyster	2.3	— .1
129	Currants	2.3	— .04
116	Salmon	2.3	— .01
130	Prunes	2.5	.1
64	Beef: fresh	2.6	.3
109	Coffee	2.7	.3
117	Flour: rye	2.8	.4
114	Herring	3.0	.6
95	Butter: creamery extra, St. Louis	3.1	.7
89	Butter: creamery extra, N. Y.	3.1	.8
90	Butter: creamery firsts, N. Y.	3.4	1.0
69	Hams: smoked	3.5	1.1
139	Meal: corn, fine white	3.5	1.1
99	Cheese	3.5	1.2
136	Glucose	3.6	1.2
113	Cod	3.7	1.3
140	Meal: corn, yellow table	3.7	1.3
68	Beef: salt	4.4	2.0
75	Pork: cured, Rough sides	4.5	2.1
76	Pork: cured, short clear sides	4.5	2.1
138	Lard	4.5	2.1
158	Cottonseed oil	4.6	2.2
74	Pork: cured, salt mess	5.1	2.6
	Cloths and clothing		
188	Women's hosiery: silk mercerized	— .1	—2.4
226	Silk: raw, Japanese Kansai, No. 1	— .05	—2.3
223	Linen shoe thread	.3	—2.0
228	Silk: raw, Japanese extra-extra	.4	—1.9
189	Women's hosiery: single thread	.8	—1.5
192	Muslin: Rough Rider	.8	—1.5
214	Underwear: union suits	1.1	—1.2
179	Calico	1.1	—1.2
212	Trousering	1.4	— .9
218	Poplar cloth	1.4	— .9
166	Men's shoes: black calf	1.4	— .9
199	Cotton thread	1.5	— .9
187	Men's hosiery	1.5	— .8
193	Muslin: Wamsutta	1.5	— .8
213	Underwear: shirts and drawers	1.5	— .8
186	Ginghams: Lancaster	1.6	— .8
219	Sicilian cloth	1.6	— .7
220	Worsted yarns: 2-32's	1.7	— .6
177	Women's shoes	1.7	— .6
198	Sheetings: 4-4 Ware Shoals	1.8	— .5
203	Cotton yarns: carded, cones 22/1	1.9	— .4
221	Worsted yarns: 2–40's	1.9	— .4
206	Flannels: white	1.9	— .4

TABLE IX (Cont.)

(1) Ref. No.	(2) Commodity	(3) Average annual rate of change in price, 1896–1913 Per cent	(4) Average annual rate of change in purchasing power, 1896–1913 Per cent
	Cloths and clothing (cont.)		
217	Storm serge	2.0	—.3
191	Muslin: Lonsdale	2.1	—.2
197	Sheetings: 4-4 Pepperell R	2.2	—.2
190	Muslin: Fruit of the Loom	2.2	—.1
174	Men's shoes: vici kid	2.2	—.1
209	Suiting: clay worsted, 16 oz.	2.2	—.1
173	Men's shoes: chocolate elk	2.3	—.05
210	Suiting: Middlesex	2.5	.1
211	Suiting: serge, 11 oz.	2.5	.1
208	Suiting: serge, 9½ oz.	2.5	.1
185	Ginghams: Amoskeag	2.5	.2
202	Cotton yarns: carded, cones 10/1	2.6	.2
184	Flannel: unbleached	2.6	.3
196	Sheetings: 4-4 Indian Head	2.7	.3
180	Denims	2.7	.4
195	Print cloths	2.8	.5
181	Drillings: Pepperell	3.0	.7
216	French serge	3.2	.8
183	Flannel: colored	3.2	.9
215	Broadcloth	3.3	.9
182	Drillings: Mass. D	4.3	1.9
	Fuel and lighting		
244	Matches	—1.2	—3.5
239	Coke	.5	—1.8
238	Bituminous coal: Pocahontas	.9	—1.4
249	Petroleum: refined, 150° fire test	.9	—1.4
248	Petroleum: refined, for export	1.1	—1.2
235	Anthracite coal: stove	1.7	—.6
237	Bituminous coal: New River	2.0	—.3
232	Anthracite coal: broken	2.0	—.3
236	Bituminous coal: Kanawha	2.1	—.2
234	Anthracite coal: egg	2.2	—.1
233	Anthracite coal: chestnut	2.3	—.1
247	Petroleum: crude	3.5	1.1
	Metals and metal products		
282	Steel sheets	—.8	—3.0
274	Shovels	—.7	—3.0
289	Wire: fence	—.5	—2.7
299	Silver	—.4	—2.7
269	Nails: wire	—.2	—2.5
287	Trowels	.1	—2.2
273	Saws: hand	.2	—2.1
291	Wood screws	.2	—2.1
286	Tin: plate	.3	—2.0
254	Files	.3	—1.9
298	Quicksilver	.5	—1.8
272	Saws: crosscut	.5	—1.8

TABLE IX (Cont)

(1) Ref. No.	(2) Commodity	(3) Average annual rate of change in price, 1896–1913 Per cent	(4) Average annual rate of change in purchasing power, 1896–1913 Per cent
	Metals and metal products (cont.)		
295	Copper: wire	.6	—1.7
267	Bar iron: from mill, Pittsburgh	.7	—1.6
297	Lead: pipe	.8	—1.5
266	Bar iron: from store, Phila.	.9	—1.4
280	Steel rails	.9	—1.4
293	Copper: ingot	1.0	—1.3
259	Pig iron: basic	1.0	—1.3
276	Steel billets	1.1	—1.2
255	Hammers	1.1	—1.2
294	Copper: sheet	1.2	—1.1
261	Pig iron: foundry No. 2 Northern	1.3	—1.0
296	Lead: pig	1.3	—1.0
260	Pig iron: Bessemer	1.4	— .9
271	Planes	1.4	— .9
263	Pig iron: foundry No. 2 Southern	1.7	— .6
251	Butts	1.7	— .6
301	Zinc: sheet	2.1	— .2
302	Zinc: slab	2.2	— .1
288	Vises	2.8	.5
252	Chisels	3.0	.7
258	Locks	4.2	1.8
253	Door knobs	5.0	2.6
250	Augers	5.4	3.0
300	Tin: pig	5.6	3.2
	Building materials		
330	Cement: Portland	—2.6	—4.8
349	Putty	—2.3	—4.6
343	Glass: plate, 5-10 sq. ft.	—1.5	—3.7
345	Glass: window, B	— .7	—3.0
342	Glass: plate, 3-5 sq. ft.	— .6	—2.8
344	Glass: window, A	— .1	—2.4
327	Brick	1.2	—1.1
354	Lead: carbonate of	1.7	— .7
308	Maple: N. Y.	2.0	— .3
355	Zinc: oxide of	2.1	— .2
335	Doors	2.4	.1
323	Shingles: cypress	2.6	.3
324	Shingles: red cedar	2.7	.4
353	Turpentine: spirits of	3.0	.6
348	Linseed oil	3.0	.7
338	Lime	3.1	.7
310	Oak: white, plain, N. Y.	3.1	.7
312	Oak: white, quartered, N. Y.	3.2	.9
321	Spruce	4.1	1.7
317	Pine: yellow siding	4.5	2.1
352	Tar	4.5	2.1
319	Poplar: N. Y.	4.7	2.3

TABLE IX (Conc.)

(1) Ref. No.	(2) Commodity	(3) Average annual rate of change in price, 1896–1913 Per cent	(4) Average annual rate of change in purchasing power, 1896–1913 Per cent
	Building materials (cont.)		
313	Pine: white boards	5.0	2.6
350	Rosin	10.2	7.7
	Chemicals and drugs		
362	Alcohol: wood	—3.4	—5.6
400	Quinine	—3.1	—5.4
377	Soda: bicarbonate of	—2.0	—4.2
360	Acid: sulphuric	— .4	—2.7
381	Sulphur	.4	—1.9
363	Alum	.4	—1.8
357	Acid: muriatic	.5	—1.8
393	Alcohol: grain	.7	—1.6
396	Glycerine	2.4	.04
382	Tallow	3.5	1.1
397	Opium	6.5	4.1
	House-furnishings		
427	Tumblers	—2.5	—4.7
426	Pitchers	—1.8	—4.0
421	Knives and forks	— .4	—2.7
420	Carvers	— .1	—2.4
424	Sheetings: 10-4 Wamsutta	.1	—2.2
429	Teacups and saucers	.2	—2.1
428	Plates	.3	—2.0
425	Nappies	.5	—1.8
418	Carpets: Brussels	1.7	— .6
417	Carpets: Axminster	1.8	— .6
416	Blankets: woolen	1.8	— .5
419	Carpets: Wilton	2.0	— .4
423	Sheetings: 10-4 Pepperell	2.0	— .3
430	Tickings: Amoskeag	2.2	— .2
412	Kitchen: chairs	3.1	.7
414	Kitchen: tables	3.1	.7
415	Blankets: cotton	3.1	.7
405	Bedroom: chairs	3.5	1.2
406	Bedroom: sets	5.0	2.6
	Miscellaneous		
443	Paper; newsprint	—1.0	—3.3
444	Paper: wrapping, Manila	— .4	—2.7
456	Tobacco: plug	.8	—1.5
457	Tobacco: smoking	1.2	—1.1
450	Rope	1.2	—1.1
455	Starch: laundry	1.3	—1.0
440	Leather: sole oak, hemlock	1.4	— .9
438	Leather: harness oak	1.7	— .7
436	Leather: calf	1.9	— .5
441	Leather: sole oak, scoured backs	1.9	— .4
451	Rubber	2.3	— .05
433	Cottonseed meal	2.9	.6
448	Jute	4.8	2.4

TABLE X

Measures Describing the Behavior of Wholesale Commodity Prices during Periods of Revival and Recession in American Business, 1890-1925

Timing of Cyclical Movements in Individual Commodity Prices at 21 Turning Points in General Prices.[1]

Ref. No.	Commodity	Periods																				
		(1) Low (May 1892)	(2) High (Feb. 1893)	(3) Low (Mar. 1895)	(4) High (Oct. 1895)	(5) Low (May 1897)	(6) High (Apr. 1900)	(7) Low (July 1901)	(8) High (Oct. 1902)	(9) Low (July 1904)	(10) High (Oct. 1907)	(11) Low (Feb. 1908)	(12) High (Apr. 1910)	(13) Low (June 1911)	(14) Hgh (Sept. 1913)	(15) Low (Nov. 1914)	(16) High (Sept. 1918)	(17) Low (Feb. 1919)	(18) High (May 1920)	(19) Low (Jan. 1922)	(20) High (Apr. 1923)	(21) Low (June 1924)
	Farm products																					
1	*Barley	+2	—1	—19	※—8	—10	—15	—16	—3	+13	0	+4	—10	※—20	—17	—4	—6	0	0	—1	—4	—10
2	*Corn	—4	—9	—13	※—14	—8	—15	※—19	—3	+19	+11	+11	※—11	—4	+11	+11	—12	0	0	—3	R	R
4	*Oats	—8	—6	—19	※—16	—8	—23	※—23	—3	+13	+13	+20	—2	—3	—17	—12	—6	0	+1	+7	R	R
5	*Rye	S	S	—18	—5	—9	—23	—8	—10	※—19	—1	I. C.	I. C.	—9	※—28	—10	—6	0	+2	—2	—11	—11
6	*Wheat	S	S	S	S	※—27	—23	—18	R	R	—32	※—16	※—11	+1	—16	※—15	—16	—8	0	S	S	—11
13	Cattle: choice to prime	+1	0	—10	—6	—12	—6	—15	—2	—12	—3	0	+2	—1	+12	+5	+4	+4	—6	—7	—5	※—14
14	Cattle: good to choice	—1	+3	—11	—6	—13	—7	—14	—2	+17	—3	—2	+2	—1	+12	+5	+6	+4	—9	—7	+4	+3
15	Hogs: heavy	—15	0	—1	—3	—8	0	—7	—3	+5	—8	0	—1	—1	—2	+13	0	—1	—10	—1	—11	※—12
16	Hogs: light	—5	0	—1	—3	—8	0	—7	—1	+5	—8	0	—1	—1	—2	+13	0	—1	—10	—2	—9	—6
17	Sheep: ewes	—9	—10	—5	—7	※—18	0	+4	—5	—8	—6	—2	—1	+2	—5	※—15	—5	+7	—1	—7	0	※—12
19	Sheep: wethers	—6	—9	—4	—5	※—18	0	+2	—6	—8	—6	—2	—1	—7	—16	※—24	—5	+8	—1	—4	0	—11
22	*Beans	0	+1	—11	—6	—1	※+17	+9	+1	+6	—31	※—9	—9	—1	—11	—8	—15	+1	—9	—6	—9	—1
25	Cotton	—2	—2	—1	0	+18	+5	+4	+17	+6	—2	+10	+4	+6	+1	+1	0	0	—1	—10	+8	S
31	*Eggs	—1	—1	—10	※—8	—1	+8	—2	+14	—3	+1	+2	R	R	+2	+6	R	R	+7	+2	—5	—2
34	*Flaxseed	—7	+1	—18	—4	—8	R	R	—15	—8	—28	※—27	+10	+18	R	R	—2	—1	—9	—9	0	+3
37	*Hay	S	S	—13	—3	+16	R	R	—3	+19	—4	+7	※+25	+20	+1	+10	0	0	0	+8	+9	+11
42	Hides	+1	—5	—9	—2	—13	—4	—12	—1	—4	—10	+1	—5	—2	+10	※—18	—10	—11	—9	—9	—5	—1
44	*Hops	—7	—9	S	S	—9	+8	+6	+17	+23	—10	+7	—5	—6	※—21	+10	—11	—4	0	S	S	※—12
47	Milk	+2	0	—9	+3	+13	+8	—1	+2	+11	+14	+16	+8	0	—9	—6	+3	+2	+19	+5	+6	+1
49	*Onions	—9	—10	—8	※—8	—12	※—36	—11	—5	+13	—7	+18	+12	+3	—17	※—19	—19	—11	—6	—9	※—13	※—20
51	*Potatoes	—2	0	—12	※—16	—12	—23	—9	+20	+11	+19	※+28	※+24	+22	+10	+1	—15	—9	0	+10	+3	+4
53	Rice	—14	—15	—18	—5	※—17	—20	—4	+2	+10	+11	S	S	+2	+15	+10	—2	+3	—9	—6	—7	—7
56	Wool: fine clothing	0	+2	+3	+6	—8	—2	—1	R	R	—25	S	S	+1	—13	—10	+3	—1	—1	—3	+1	0
59	Wool: medium	S	S	+3	+5	—8	—1	—1	R	R	—28	+4	—2	+4	—9	—8	—5	+3	—5	—3	+1	0
	Foods																					
64	Beef: fresh	+1	+6	—12	—6	—13	—7	—4	—3	+16	—2	0	0	+1	+11	+5	—3	+4	+4	0	+8	+5

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[1] The figures in the various columns indicate the number of months by which the price turns of specific commodities precede (—) or lag behind (+) the major turns of the general price index. The symbols I. C., C, S and R represent, respectively, irregularly constant, constant, sagging, and rising prices. The dates of the reference points are given at the heads of the several columns. For a detailed explanation of the method employed, and for an explanation of the periods, see text, pp. 78-82.

*The commodities marked with an asterisk have price movements which are irregular, in the sense that they do not conform in any systematic fashion to the cyclical movements of general prices. For a more detailed explanation, see text, pp. 81, 102.

※These entries fall outside the normal limits defining given cyclical phases. For an explanation of these limits, see text, pp. 80-81.

TABLE X (Cont.)

Ref. No.	Commodity	Periods																				
		(1) Low (May 1892)	(2) High (Feb. 1893)	(3) Low (Mar. 1895)	(4) High (Oct. 1895)	(5) Low (May 1897)	(6) High (Apr. 1900)	(7) Low (July 1901)	(8) High (Oct. 1902)	(9) Low (July 1904)	(10) High (Oct. 1907)	(11) Low (Feb. 1908)	(12) High (Apr. 1910)	(13) Low (June 1911)	(14) High (Sept. 1913)	(15) Low (Nov. 1914)	(16) High (Sept. 1918)	(17) Low (Feb. 1919)	(18) High (May 1920)	(19) Low (Jan. 1922)	(20) High (Apr. 1923)	(21) Low (June 1924)
	Foods (cont.)																					
68	Beef: salt	+3	+8	0	—4	—8	0	—4	—4	—1	+11	+15	+6	+1	+12	+12	R	R	※—11	+10	—1	—9
69	Hams	—16	0	—1	—3	+16	+1	—8	+10	+6	—5	0	+3	+7	+12	+4	※+11	+9	+2	—1	—10	—4
71	Mutton	—6	—8	—4	※—8	※—18	0	+4	—5	—8	+6	+7	0	+5	+20	+10	—4	+7	—1	—2	+12	+4
74	Pork, cured salt mess	0	+3	—1	—6	—10	—23	※—26	—3	+4	—3	0	—1	+4	+11	+10	—5	—4	—10	0	—9	—4
75	Pork: cured, rough sides	—15	0	S	S	—8	—23	※—26	0	—2	—8	0	—1	+6	+11	+10	—11	—8	※—12	—3	—10	—2
76	Pork: cured, short clear sides	—15	0	S	S	—9	—21	※—26	0	—2	—8	0	—1	+6	+11	+10	—11	—8	—10	—3	—10	—5
89	*Butter: creamery extra N. Y.	—10	—1	—10	+2	+1	—4	—2	+2	0	—8	+5	—4	—2	—20	—7	+3	0	—5	—8	+8	+3
90	*Butter: creamery firsts, N. Y.	—10	+2	—10	※—11	+2	—3	—2	+2	0	—8	+6	—4	—2	—20	—7	+3	0	—1	—8	+8	+4
95	*Butter: creamery extra St. Louis	—10	—1	—10	+2	+1	—4	—2	+2	0	—8	+5	—4	—2	—20	—7	+3	0	—5	—8	+8	+3
99	*Cheese	—10	—11	—9	—7	—10	—1	—1	+6	0	—5	+5	—1	+2	—18	※—18	+3	0	—6	—7	—3	—2
104	Bread: Cincinnati	C	C	C	C	C	C	C	+14	C	C	+14	C	+18	R	R	—10	—11	+6	C	C	+7
106	Bread: N. Y.	C	C	C	C	C	C	C	+14	0	C	C	C	+6	+18	+21	—1	+3	+7	0	—4	—4
109	Coffee	0	+11	—4	—7	+29	+4	※+19	+16	—3	—14	—2	+19	+12	—9	+1	—15	—14	—10	—9	—1	—9
111	Crackers: oyster	S	C	C	+16	+1	—22	—13	+9	—4	C	+21	+20	C	C	+4	+6	+8	+6	C	C	+5
112	Crackers: soda	S	S	※+19	+16	+7	—22	—13	+5	—12	C	+21	+8	C	C	+4	+6	+8	+6	C	C	+5
113	Cod	R	—11	S	S	—8	+4	—10	—14	※—22	—3	※+29	+13	+17	+17	+10	+5	+13	+1	+7	+9	+15
114	Herring	+3	+7		S	※—21	—4	+10	+11	—2	+2	+17	—5	+3	C	+11	+1	+5	—3	C	C	—7
115	Mackerel	—5	+4	—8	+7	+1	+2	—2	+5	+22	—10	+16	+12	+11	—9	+7	+3	+15	+9	+16	R	R
116	Salmon	+5	+5	+3	—2	+15	+11	+14	※+28	+27	+4	※+31	R	R	C	+1	+2	+3	+3	+8	R	R
117	*Flour: rye	S	S	—2	—3	+2	—22	※—34	※+27	+27	+2	※+31	+14	S	S	—4	—6	+7	+1	S	S	—3
119	*Flour: wheat, winter straights	S	S	—5	—4	—9	—23	—17	+25	+30	0	+6	—10	—2	—16	—4	—16	—1	0	S	S	—11
120	*Flour: wheat, standard patents	S	S	—5	—4	※—17	—23	—14	+23	+26	+3	+2	—10	—10	—16	※—13	—16	—9	0	S	S	—11
128	*Apples	0	+16	S	S	—1	—22	—9	—2	+5	—14	+16	+16	+23	+11	+21	—10	—6	—5	—10	—12	—8
129	*Currants	S	S	—10	—6	※—23	※—26	※—26	※—24	+10	—10	+6	+9	+4	—18	+1	—7	+3	—8	+1	—3	—2
130	Prunes	—5	—3	—11	※—11	+1	—16	0	—11	+10	—16	※—9	+18	+23	+8	+17	—14	—8	—10	—9	—8	+1
131	Raisins	+2	—3	—11	—5	—13	+7	—5	+2	+14	+12	+27	R	R	+15	+23	R	R	+10	S	S	+2
138	Lard	—15	0	S	S	—9	R	R	0	—2	—8	0	—1	—2	—11	+8	—10	—1	—10	—1	+7	—1
139	Meal: corn, fine white	S	S	—13	※—13	—8	—11	—18	—3	—14	+11	+11	—1	+1	—14	※—18	—13	0	+1	0	+6	—1
140	Meal: corn, yellow table	S	S	—13	※—13	—8	—11	—18	0	—14	+11	+12	—1	—5	—14	※—18	—4	+2	+1	0	+6	—1
141	Molasses	—18	+9	+9	+12	+2	+3	—4	—11	+16	+1	+22	R	R	+17	+33	R	R	+5	+6	R	R
145	Pepper	+3	—3	—1	—4	—15	+7	+11	0	S	S	+9	R	R	—19	※—19	—3	+2	—10	—4	+10	0
146	*Salt	+2	0	—12	—6	—4	+11	※+23	※+28	+22	—4	+4	—2	—11	—9	+1	R	R	+13	+13	C	C

TABLE X (Cont.)

Ref. No.	Commodity	Periods																				
		(1) Low (May 1892)	(2) High (Feb. 1893)	(3) Low (Mar. 1895)	(4) High (Oct. 1895)	(5) Low (May 1897)	(6) High (Apr. 1900)	(7) Low (July 1901)	(8) High (Oct. 1902)	(9) Low (July 1904)	(10) High (Oct. 1907)	(11) Low (Feb. 1908)	(12) High (Apr. 1910)	(13) Low (June 1911)	(14) High (Sept. 1913)	(15) Low (Nov. 1914)	(16) High (Sept. 1918)	(17) Low (Feb. 1919)	(18) High (May 1920)	(19) Low (Jan. 1922)	(20) High (Apr. 1923)	(21) Low (June 1924)
	Foods (cont.)																					
148	Starch: corn	C	+ 11	— 6	* — 9	C	* +14	0	R	R	+ 8	+ 10	C	C	C	— 3	— 13	+ 1	+ 1	+ 17	C	C
149	*Sugar: raw	+ 2	+ 4	— 10	+ 6	— 7	+ 5	+ 12	* +27	+ 31	+ 6	+ 12	+ 18	S	S	— 7	— 13	— 8	0	0	+ 1	+ 1
150	*Sugar: granulated	— 3	+ 5	— 1	+ 6	— 4	+ 5	+ 16	* +30	+ 19	+ 7	+ 12	+ 18	S	S	— 7	— 10	— 8	0	0	+ 1	+ 1
152	*Tea	+ 2	— 1	— 7	— 4	— 9	— 12	+ 5	+ 2	— 9	* —36	+ 13	— 9	+ 1	+ 13	+ 29	+ 5	+ 2	+ 2	— 5	C	+
158	Cottonseed oil	— 1	0	0	+ 2	+ 7	+ 1	— 6	— 4	+ 6	— 3	+ 1	+ 5	+ 7	— 2	— 1	— 7	— 8	— 10	— 9	+ 6	—
161	*Vinegar	C	— 9	C	— 1	+ 16	+ 2	+ 2	— 1	+ 2	+ 13	* +31	+ 13	* +31	+ 15	+ 5	+ 2	+ 4	+ 1	— 6	— 11	+
	Cloths and clothing																					
166	Men's shoes: black calf	C	C	C	C	C	C	— 7	R	C	— 10	+ 10	0	+ 10	R	R	R	R	0	+ 11	— 3	+
173	Men's shoes: chocolate elk	S	S	— 2	— 3	+ 11	+ 2	— 1	— 10	+ 9	— 4	+ 2	— 6	0	R	R	R	R	0	+ 10	+ 4	+
174	Men shoes: vici kid	C	C	S	S	C	C	C	C	+ 3	R	R	C	R	+ 3	— 6	R	R	0	+ 10	C	C
177	Women's shoes	S	S	— 3	+ 1	+ 31	+ 3	+ 3	R	R	— 15	+ 4	0	0	R	R	R	R	0	+ 12	R	R
179	Calico	— 5	+ 4	+ 3	+ 8	+ 25	+ 2	C	I. C.	+ 13	+ 3	+ 5	0	+ 8	— 2	+ 1	— 5	+ 2	— 1	+ 7	+ 2	+ 1
180	Denims	— 2	+ 10	+ 6	+ 5	+ 22	+ 10	— 2	+ 20	+ 10	0	+ 9	0	+ 8	+ 3	+ 3	— 5	+ 1	+ 4	— 5	+ 8	
181	Drillings: Pepperell	+ 6	0	+ 3	+ 3	+ 20	+ 2	* +21	+ 18	+ 7	+ 2	+ 14	+ 12	+ 6	+ 3	+ 9	— 5	+ 2	+ 4	— 5	+ 9	
182	Drillings: Mass D	+ 1	+ 3	+ 2	+ 2	+ 9	+ 8	— 3	+ 16	+ 1	— 5	+ 2	+ 9	+ 7	+ 1	+ 2	— 2	+ 1	0	— 5	+ 9	
183	Flannel: colored	S	S	S	S	+ 19	+ 8	+ 5	+ 18	+ 8	0	+ 20	+ 20	+ 8	+ 3	+ 9	— 2	+ 2	+ 4	— 10	+ 8	
184	Flannel: unbleached	S	S	+ 9	+ 26	+ 19	+ 9	+ 5	+ 18	+ 5	0	+ 20	+ 20	+ 8	+ 3	+ 10	+ 3	+ 2	+ 4	— 5	+ 8	
185	Ginghams: Amoskeag	— 17	+ 1	+ 3	+ 5	+ 19	+ 5	+ 1	+ 22	+ 12	— 1	+ 8	+ 17	+ 19	— 2	+ 10	+ 3	+ 2	+ 3	— 12	+ 8	+ 8
186	Ginghams: Lancaster	C	+ 1	+ 2	+ 4	— 9	+ 11	+ 5	+ 23	+ 12	+ 2	+ 8	+ 1	+ 18	— 1	+ 11	+ 3	+ 2	— 2	— 10	+ 5	C
190	Muslin: Fruit of the Loom	— 5	+ 4	+ 1	+ 4	+ 19	+ 3	— 9	+ 20	+ 9	+ 3	+ 4	— 1	+ 8	+ 15	+ 2	+ 3	+ 2	+ 2	— 6	+ 1	— 8
191	Muslin: Lonsdale	+ 6	+ 4	0	+ 4	+ 19	+ 11	— 1	+ 20	+ 9	+ 1	+ 4	— 1	+ 7	+ 4	+ 2	+ 3	+ 2	+ 2	+ 5	+ 9	+ 1
192	Muslin: Rough Rider	+ 7	+ 5	+ 8	+ 16	+ 30	+ 6	+ 12	+ 13	— 3	+ 3	+ 16	— 4	+ 7	+ 6	+ 10	+ 2	+ 1	— 1	— 9	— 1	— 10
193	Muslin: Wamsutta	+ 9	+ 5	+ 2	+ 3	+ 20	+ 4	+ 9	+ 14	+ 11	+ 7	+ 18	+ 8	+ 9	+ 15	+ 10	— 1	+ 2	+ 3	+ 9	C	C
195	Print cloths	— 9	— 2	0	0	+ 12	— 3	— 1	+ 17	+ 10	0	+ 7	— 2	+ 5	— 9	+ 1	— 5	+ 1	— 1	— 6	+ 8	S
196	Sheetings: 4-4 Indian Head	0	+ 5	+ 1	+ 16	+ 20	+ 11	+ 18	+ 20	+ 14	+ 4	+ 19	+ 13	+ 9	+ 4	+ 5	— 2	+ 2	0	— 5	+ 10	S
197	Sheetings: 4-4 Pepperell R	— 1	+ 12	+ 3	+ 3	+ 19	+ 10	+ 13	+ 20	+ 7	+ 3	+ 16	— 1	+ 6	+ 4	+ 1	— 5	+ 2	— 4	— 5	+ 10	+ 14
198	Sheetings: 4-4 Ware Shoals	+ 1	+ 7	+ 2	0	+ 18	— 1	(2)	+ 18	+ 6	— 1	+ 8	— 3	+ 7	— 9	+ 2	— 2	+ 2	0	— 6	+ 8	+ 13
199	Cotton thread	C	C	C	+ 8	+ 31	C	C	C	C	+ 4	C	C	C	C	+ 19	+ 4	+ 9	— 2	* +23	C	C

(2) No. sales

TABLE X (Cont.)

Ref. No.	Commodity	Periods																				
		(1) Low (May 1892)	(2) High (Feb. 1893)	(3) Low (Mar. 1895)	(4) High (Oct. 1895)	(5) Low (May 1897)	(6) High (Apr. 1900)	(7) Low (July 1901)	(8) High (Oct. 1902)	(9) Low (July 1904)	(10) High (Oct. 1907)	(11) Low (Feb. 1908)	(12) High (Apr. 1910)	(13) Low (June 1911)	(14) High (Sept. 1913)	(15) Low (Nov. 1914)	(16) High (Sept. 1918)	(17) Low (Feb. 1919)	(18) High (May 1920)	(19) Low (Jan. 1922)	(20) High (Apr. 1923)	(21) Low (June 1924)
	Cloths and clothing (cont.)																					
202	Cotton yarns: carded, cones 10/1	− 12	− 6	0	+ 3	+ 25	+ 6	+ 4	+ 16	+ 10	− 2	+ 8	+ 8	+ 7	+ 1	+ 4	− 3	+ 1	− 1	− 9	+ 8	S
203	Cotton yarns: carded, cones 22/1	− 12	− 7	− 1	+ 3	+ 22	+ 6	+ 7	+ 16	+ 11	− 2	+ 2	+ 13	+ 7	+ 1	+ 4	− 3	+ 1	0	− 9	+ 8	+ 11
206	Flannels: white	S	S	+ 3	+ 9	− 8	+ 7	+ 4	R	R	+ 7	+ 17	+ 7	+ 8	+ 2	− 4	+ 4	+ 3	+ 6	+ 2	+ 4	+ 8
210	Suiting: Middlesex	C	+ 4	S	S	+ 7	C	0	R	R	+ 2	+ 22	− 1	+ 13	− 1	− 3	+ 4	+ 3	+ 1	+ 3	+ 13	+ 3
213	Underwear: shirts and drawers	− 17	+ 10	C	C	+ 19	C	C	C	+ 17	C	C	C	C	C	+ 16	+ 3	+ 10	+ 7	+ 1	C	C
214	Underwear: union suits	− 17	+ 10	C	C	+ 31	C	C	C	+ 17	C	C	C	C	C	+ 16	(3)	(3)	+ 2	+ 5	R	R
215	Broadcloth	+ 1	− 2	S	S	− 12	+ 9	− 1	R	R	+ 2	+ 10	+ 2	+ 6	− 15	− 11	(3)	(3)	+ 2	+ 5	R	R
216	French serge	− 14	− 2	S	S	− 5	+ 4	C	C	− 13	+ 2	+ 10	+ 2	+ 18	0	+ 1	+ 5	+ 2	+ 7	+ 8	R	R
217	Storm serge	− 18	+ 8	+ 6	+ 8	+ 2	+ 5	+ 3	+ 12	+ 1	− 11	− 2	+ 1	S	S	− 3	+ 5	+ 2	+ 3	+ 8	C	C
218	Poplar cloth	S	S	S	S	+ 26	C	C	− 1	− 10	+ 10	+ 21	+ 19	C	C	+ 9	+ 2	+ 4	+ 7	+ 9	C	C
219	Sicilian cloth	C	− 8	C	C	+ 26	C	C	− 1	− 9	C	C	+ 2	+ 10	0	− 3	+ 5	+ 3	+ 7	+ 8	R	R
220	Worsted yarns: 2-32's	+ 5	− 3	+ 6	+ 8	− 3	− 2	− 1	+ 7	+ 2	− 15	+ 9	− 5	+ 8	− 7	+ 4	+ 2	+ 3	− 3	− 13	+ 3	+ 1
221	Worsted yarns: 2-40's	− 3	− 6	S	S	− 5	0	− 1	+ 6	− 7	0	+ 8	− 6	+ 10	− 7	− 9	+ 1	+ 1	0	− 1	0	+ 2
223	Linen shoe thread	※ +17	+ 19	C	C	※ +32	C	C	+ 2	+ 16	C	C	C	C	C	− 1	R	R	+ 5	S	S	+ 6
226	Silk: raw, Japanese, Kansai No 1	− 7	+ 2	− 9	+ 1	− 12	− 4	− 5	+ 5	0	− 5	+ 3	※ −13	+ 5	− 1	+ 1	+ 2	− 1	− 4	※ −18	+ 5	− 1
228	Silk: raw, Japanese, extra-extra	− 6	+ 3	− 9	− 1	+ 1	− 4	− 2	+ 12	− 1	− 5	+ 2	− 7	− 5	0	+ 2	+ 2	− 1	− 4	※ −17	+ 5	− 1
	Fuel and lighting																					
232	Anthracite coal: broken	− 3	− 6	+ 6	+ 5	+ 27	+ 5	− 9	I. C.	I. C.	I. C.	I. C.	C	+ 10	I. C.	+ 17	+ 5	+ 13	R	I. C.	R	I. C.
233	Anthracite coal: chestnut	− 3	− 4	+ 6	+ 13	+ 8	+ 10	+ 9	I. C.	I. C.	I. C.	I. C.	I. C.	+ 1	I. C.	+ 13	R	R	R	I. C.	R	I. C.
234	Anthracite coal: egg	− 3	− 4	+ 6	+ 13	+ 25	R	R	I. C.	I. C.	I. C.	I. C.	I. C.	+ 12	I. C.	+ 13	R	R	R	I. C.	R	I. C.
235	Anthracite coal: stove	−3	− 4	+ 5	+ 13	+ 22	R	I. C.	I. C.	I. C.	I. C.	I. C.	I. C.	+ 13	I. C.	+ 13	R	R	R	I. C.	R	I. C.
236	Bituminous coal: Kanawha	0	0	− 11	+ 2	+ 22	− 3	+ 7	+ 5	+ 20	+ 2	※ +32	+ 11	+ 24	+ 3	+ 21	− 15	− 16	+ 7	+ 3	− 7	C
237	Bituminous coal: New River	− 14	+ 13	+ 3	+ 16	+ 10	(4)	+ 8	0	S	S	※ +30	+ 11	+ 7	+ 3	− 3	− 14	− 16	+ 7	+ 3	− 3	+ 14

(3) No quotation. (4) Strike.

TABLE X (Cont.)

Ref. No.	Commodity	Periods																				
		(1) Low (May 1892)	(2) High (Feb. 1893)	(3) Low (Mar. 1895)	(4) High (Oct. 1895)	(5) Low (May 1897)	(6) High (Apr. 1900)	(7) Low (July 1901)	(8) High (Oct. 1902)	(9) Low (July 1904)	(10) High (Oct. 1907)	(11) Low (Feb. 1908)	(12) High (Apr. 1910)	(13) Low (June 1911)	(14) High (Sept. 1913)	(15) Low (Nov. 1914)	(16) High (Sept. 1918)	(17) Low (Feb. 1919)	(18) High (May 1920)	(19) Low (Jan. 1922)	(20) High (Apr. 1923)	(21) Low (Jun 1924
	Fuel and lighting																					
238	Bituminous coal: Pocahontas	+7	+13	0	+2	+22	—1	—4	0	+27	+1	I. C.	I. C.	I. C.	I. C.	+13	—15	—16	+9	+3	—3	+
239	Coke	+7	+1	—10	+16	0	0	—4	+5	0	—8	+8	—6	+5	—8	0	—14	+3	+3	—1	—8	+
244	Matches	C	+18	0	C	C	C	C	—6	C	C	C	C	C	C	+4	C	C	R	C	C	
247	Petroleum: crude	+5	+16	—7	—6	+8	—1	—1	+14	+14	+19	S	S	+6	+7	+9	R	R	+7	—5	—1	—
248	Petroleum: refined for export	S	S	—3	+3	+9	—1	0	+14	+14	+11	S	S	+3	+8	+11	R	R	+8	+7	0	—
249	Petroleum: refined 150° fire test	S	S	—3	+6	+17	—1	0	+16	+14	+17	S	S	+6	—1	+33	R	R	+8	+4	—1	—
	Metals and metal products																					
250	Augers	C	—2	C	C	—13	+8	+5	R	R	+15	+25	+8	+6	C	+14	R	R	+9	C	C	
251	Butts	+7	+10	+4	+2	* +32	+1	0	C	C	C	+18	+8	C	C	+1	+8	+5	+6	+11	+17	+
252	Chisels	C	—2	+9	+13	+18	+8	+5	R	R	+1	+25	+8	C	C	+12	R	R	+9	+11	C	
253	Door knobs	C	C	+1	+4	* +37	+6	+9	+2	—6	—10	+25	+8	+6	C	+1	+5	+7	+8	+6	+17	
254	Files	S	S	S	S	—1	+4	C	C	S	S	S	C	C	S	+8	+6	+13	+7	+7	R	
255	Hammers	C	C	+8	+28	+23	R	C	R	C	C	C	+8	C	C	+13	R	R	+11	+17	+6	+
258	Locks	C	+17	+5	+8	* +37	+5	+9	+25	+6	+2	+25	+8	+6	C	+3	+5	+7	+8	+12	+17	
259	Pig iron: basic	+11	+5	+1	0	+14	—3	+3	+1	0	—9	+6	—3	+8	—8	0	—14	+8	+4	+1	—7	+
260	Pig iron: Bessemer	+9	+2	—2	—1	+2	—2	—9	+1	0	—4	+8	—3	+8	—6	+5	—14	+8	+4	+2	—7	+
261	Pig iron: foundry No. 2, Northern	+8	+3	0	0	+1	—4	—7	+1	0	—4	+8	—5	+8	—8	+7	—14	+7	+4	+1	—7	+
263	Pig iron: foundry No. 2 Southern	+4	—1	+1	+1	0	—5	—8	+3	0	—6	+3	—5	+1	—10	+4	—12	+5	+5	+2	0	+
266	Bar iron: from store, Phila.	—2	—6	—1	—1	+4	—3	—9	+6	+4	—1	+15	—1	+10	—6	+4	+3	+5	+5	+3	+4	+
267	Bar iron: from mill Pitts.	0	—7	+1	—1	+2	—6	—8	—4	—6	—22	+15	—4	+6	—3	+4	—6	+8	+5	+4	+6	+
269	Nails: wire	+9	+3	—2	+13	+19	0	S	S	+4	+8	+15	+3	+6	—2	+2	—11	+7	—3	+6	+12	+
271	Planes	C	+12	C	C	+31	R	R	R	C	—10	+25	+8	C	S	+13	R	R	+6	C	C	
272	Saws: crosscut	C	C	C	C	C	C	C	C	C	C	C	C	C	C	+13	R	R	+13	+8	C	
273	Saws: hand	C	C	C	C	C	C	C	C	+17	C	C	C	C	C	+15	R	R	+13	+8	C	
274	Shovels	C	+10	C	C	—14	C	C	+1	+29	+13	+24	+6	+17	—5	+11	+3	+10	+14	+9	C	
276	Steel billets	+9	+2	—2	—1	0	—6	—9	—4	+3	—5	+17	—1	+6	—5	+1	—14	+8	+2	+2	0	+
280	Steel rails	—17	—2	+3	+14	+18	+4	—3	C	C	C	C	C	C	C	+18	+5	+10	+6	+8	C	
287	Trowels	C	C	C	C	C	C	C	C	C	C	C	C	C	C	+31	R	R	+14	+13	C	
288	Vises	+1	+1	+6	+2	+21	R	R	+11	+22	—10	+10	+2	S	S	+4	+4	+10	+7	+11	+14	+
289	Wire: fence	S	S	+1	+1	+3	—1	—6	—4	+3	+7	+15	—1	+6	—1	—4	—11	+7	+5	+6	+12	+
291	Wood screws	R	+13	+1	+2	+7	+8	* +19	+14	+5	+2	+12	+8	+6	—9	—5	—10	+4	+9	+1	+15	
293	Copper: ingot	—2	—1	—9	0	—8	—11	+14	+6	—7	—5	+14	—2	—1	—11	0	—18	+1	—9	—5	0	+

TABLE X (Cont.)

Ref. No.	Commodity	Periods																				
		(1) Low (May 1892)	(2) High (Feb. 1893)	(3) Low (Mar. 1895)	(4) High (Oct. 1895)	(5) Low (May 1897)	(6) High (Apr. 1900)	(7) Low (July 1901)	(8) High (Oct. 1902)	(9) Low (July 1904)	(10) High (Oct. 1907)	(11) Low (Feb. 1908)	(12) High (Apr. 1910)	(13) Low (June 1911)	(14) High (Sept. 1913)	(15) Low (Nov. 1914)	(16) High (Sept. 1918)	(17) Low (Feb. 1919)	(18) High (May 1920)	(19) Low (Jan. 1922)	(20) High (Apr. 1923)	(21) Low (June 1924)
	Metals and metal products (cont.)																					
294	Copper: sheet	S	S	+4	0	—13	—3	+7	+11	+5	—3	+21	+1	0	—8	0	—17	+2	—8	+4	0	+1
295	Copper: wire	—4	—7	—8	0	+8	—12	+6	+6	—5	—3	+14	—4	+5	—10	0	—17	+1	—8	—4	0	+1
296	Lead: pig	+7	+2	—2	—2	—8	+1	+6	+6	—10	—7	—1	—3	+9	—11	0	—15	+3	—2	—10	+12	+1
297	Lead: pipe	S	S	C	C	—4	+1	—6	+6	+1	—5	+1	—1	+12	—11	+2	—14	+3	+3	—5	0	—11
298	Quicksilver	+9	+5	—1	—4	—8	+2	S	S	+10	+7	+6	+12	+23	+1	—5	+2	+2	—1	—3	—3	—3
299	Silver	S	S	—12	+9	+9	+6	+18	+12	—3	—11	+10	+7	+2	—11	+9	R	R	—4	—10	—10	—10
300	Tin: pig	—4	—8	0	+1	—7	—1	+6	+5	0	—5	—1	+14	+4	—8	—1	—4	+9	—4	—5	+10	0
301	Zinc: sheet	S	S	—10	R	+12	—10	+11	+13	—6	—3	+15	—3	0	—8	—3	—38	+4	+5	+5	0	—11
302	Zinc: slab	S	S	—1	0	—8	—11	+1	+9	+1	—8	—1	—4	*—13	—11	—3	—39	+3	—4	—4	—1	+1
	Building materials																					
306	Hemlock: N. Y.	S	C	—2	+6	+10	+1	+8	C	+9	+2	+11	—1	—7	+10	+11	R	R	+7	+11	I. C.	I. C.
308	Maple: N. Y.	C	C	C	C	+27	0	+2	+14	+8	+7	+27	R	R	C	+16	+8	+6	+8	+8	+5	—4
310	Oak: white, plain, N. Y.	—3	+12	C	C	+20	+2	+1	R	R	—5	+17	I. C.	I. C.	—3	+11	R	R	0	—3	+2	+8
312	Oak: white, quartered, N. Y.	C	+12	+1	+22	+24	+1	+1	+21	+18	C	C	+13	+19	+14	+30	+3	+3	+5	—3	+16	+6
313	Pine: white boards	+4	+7	S	S	+20	+11	—1	+14	+10	+7	+11	+18	+26	C	+26	+4	+5	+7	+7	0	S
317	Pine: yellow siding	C	C	S	S	+6	+1	—2	C	0	C	+10	—7	+5	—3	+12	R	R	+1	—5	+1	+3
319	Poplar: N. Y.	+6	+10	C	C	+20	+2	+1	+20	+18	—5	+17	+7	+20	+1	+13	+3	—1	+3	—3	+4	+7
321	Spruce	—4	+2	—5	+20	+24	+1	—11	—2	—14	—13	+6	—10	+4	+8	+15	R	R	0	+3	+1	+4
323	Shingles: cypress	S	S	S	S	+7	C	C	—5	—15	0	+18	—1	—7	—6	+11	R	R	—1	+8	C	C
324	Shingles: red cedar	+6	+7	S	S	+25	R	R	+20	+17	—2	+9	0	+8	—12	+8	—16	—4	—3	—10	—8	0
327	Brick	+3	+1	—6	—7	+5	—2	—10	+16	—3	—20	+7	*—11	—6	—4	+1	R	R	+2	—1	+3	+10
335	Doors	+5	—1	S	S	+2	R	R	+2	—7	+4	+22	—1	+9	—6	+17	R	R	—5	—4	+2	S
338	Lime	+3	+2	+10	+5	—5	—23	—10	R	R	C	C	+17	S	S	S	+3	—1	(5)	+1	+6	S
344	Glass: window, A	+3	+15	+4	+15	—1	—5	—16	—18	—9	—11	+5	+5	+12	R	R	+6	+5	—5	+8	+15	+17
345	Glass: window, B	+3	+15	+4	+15	—1	—5	—16	—18	—9	—10	+5	+5	+12	—3	—2	+6	+5	—5	+8	+15	+17
348	Linseed oil	—2	+6	—16	—2	+2	+7	—6	—14	—6	+1	+3	+11	+19	+11	0	—1	0	—9	—9	0	—2
349	Putty	+3	+19	C	C	+20	+11	+9	+5	+4	C	C	—3	C	C	+14	—2	+10	—1	S	S	C
350	Rosin	+5	+1	—18	+7	+29	+9	+2	R	R	—4	+7	+12	+2	—20	+7	+2	+3	0	—9	0	0
352	Tar	S	S	—10	*—11	+11	+8	—3	+19	+8	—6	+13	+8	+8	+5	+11	—8	—11	+2	+7	C	(6)
353	Turpentine: spirits of	+4	+1	—19	—6	—8	0	—2	+6	—14	—7	+8	+12	+18	+5	+10	R	R	—1	—10	—1	+6
354	Lead: carbonate of	—11	—2	—13	+3	—3	+10	+18	+9	+4	—9	+22	+19	+12	+2	—11	+3	+8	+5	+9	+2	—6
355	Zinc: oxide of	—5	—13	+3	+4	+7	+2	—8	C	+16	+2	+20	+19	+17	C	+7	—9	+10	+5	+11	+2	+13
	Chemicals and drugs																					
357	Acid: muriatic	+3	—1	—3	—4	—5	R	R	—6	C	C	C	S	C	C	+7	—5	+5	+6	S	S	S
360	Acid: sulphuric	—14	—2	C	C	—6	R	R	—9	—15	—28	C	C	C	C	+7	—5	+6	+1	+15	+9	C
362	Alcohol: wood	—12	+7	—11	+12	—5	0	+7	+9	—7	—10	+3	C	C	—6	+11	—7	—9	+4	+7	+4	+1
363	Alum	—3	+16	+7	+15	—2	C	C	+5	—14	C	C	C	C	C	—3	+2	+8	+6	+7	C	C
377	Soda: bicarbonate of	+7	—1	S	S	+29	+6	+13	+14	C	+4	C	C	C	C	+11	+2	+13	+5	+13	+4	C
381	Sulphur	S	S	S	S	—14	—23	—13	+1	+13	—9	—1	C	C	C	+15	—9	S	S	S	C	+11

(5) Change of grade. (6) Discontinued.

TABLE X (Conc.)

Ref. No.	Commodity	Periods																				
		(1) Low (May 1892)	(2) High (Feb. 1893)	(3) Low (Mar. 1895)	(4) High (Oct. 1895)	(5) Low (May 1897)	(6) High (Apr. 1900)	(7) Low (July 1901)	(8) High (Oct. 1902)	(9) Low (July 1904)	(10) High (Oct. 1907)	(11) Low (Feb. 1908)	(12) High (Apr. 1910)	(13) Low (June 1911)	(14) High (Sept. 1913)	(15) Low (Nov. 1914)	(16) High (Sept. 1918)	(17) Low (Feb. 1919)	(18) High (May 1920)	(19) Low (Jan. 1922)	(20) High (Apr. 1923)	(21) Low (June 1924)
	Chemicals and drugs (cont.)																					
382	Tallow	+2	0	—1	—6	—9	0	—13	—5	—1	—7	+1	+8	0	+3	+10	+1	0	—10	—7	—1	0
393	Alcohol: grain	+7	—1	—9	—4	—2	—7	—11	—10	—9	R	R	*—15	—10	—16	*—15	—11	+7	+6	+7	R	R
396	Glycerine	S	S	—7	+7	+11	*+14	S	S	+28	+5	+6	+8	+9	+12	+6	—9	+2	+4	—3	—1	—11
397	Opium	+3	+13	+6	+10	—2	—20	*—25	+10	0	—1	+18	+1	—7	—19	—12	—7	+13	+8	0	R	R
400	Quinine	+10	+16	+9	+3	+2	—12	+14	+5	+28	—8	C	C	+10	+14	+6	+5	+9	+4	C	C	C
	House-furnishings																					
405	Bedroom chairs	S	S	C	S	+16	+8	+9	C	+17	+7	C	C	+6	C	+13	R	R	+6	+9	+14	S
406	Bedroom sets	S	S	S	S	+7	C	+5	C	+23	+8	+20	R	R	+3	+13	+3	+3	+6	+8	+3	S
412	Kitchen chairs	—5	+10	C	+26	+16	+7	+9	+15	+23	+16	*+34	R	+6	C	+16	+3	+3	+5	+11	+3	S
414	Kitchen tables	C	+10	C	+2	+25	C	C	C	+23	C	+23	C	+6	C	+15	R	R	+7	+8	+3	S
417	Carpets: Axminster	+7	+10	S	S	+1	+8	+15	R	R	+6	C	C	+10	+1	+5	+5	+2	+5	+3	+12	+4
418	Carpets: Brussels	—17	—11	C	C	+1	C	+15	R	R	+6	+14	C	+10	+1	+5	+5	+1	+11	+8	+12	+4
419	Carpets: Wilton	—17	—14	C	C	+1	R	C	R	+5	+6	+14	C	+10	+1	—1	+5	+2	+5	+8	+12	+2
422	Pails	S	S	+10	+11	+12	C	C	R	R	+15	C	+8	+20	R	R	R	R	+3	+3	+1	—5
423	Sheeting: 10-4 Pepperell	+12	+6	+2	+3	+10	+2	—11	+20	+10	+3	+11	—1	+8	+3	+2	+3	+3	—3	—6	+1	+15
424	Sheeting: 10-4 Wamsutta	+6	+5	+8	C	+29	+4	*+23	+14	+27	+3	+10	+12	+17	+15	+4	+3	+1	+3	+11	C	C
425	Nappies	C	C	C	+2	*+43	C	C	C	C	+2	C	C	*+30	R	R	R	R	+7	S	S	S
426	Pitchers	C	C	C	+14	*+43	C	C	+14	C	+9	+10	*—11	*+30	+15	+13	R	R	+7	+11	+17	+20
427	Tumblers	—17	—14	S	S	+31	C	+5	+2	C	+7	C	+8	+18	+15	+13	+6	C	+7	+8	+5	+4
428	Plates	S	C	S	S	+7	C	C	+2	C	C	+25	C	C	C	+16	R	R	+12	+11	+20	C
429	Teacups and saucers	S	C	S	S	+7	C	C	+2	C	C	+25	C	C	C	+16	R	R	+12	+11	+20	C
430	Tickings: Amoskeag	+7	+7	0	+5	+19	+9	+1	+20	+11	+2	+8	—1	—10	—4	+10	—1	+2	+2	—6	+8	S
431	Tubs	S	—1	C	C	+30	C	C	C	+31	C	C	+20	+20	R	R	R	R	+2	+3	+1	+13
	Miscellaneous																					
433	Cottonseed meal	+4	+1	—1	+3	+14	+7	0	—9	+7	—14	+1	—2	—2	—13	0	R	R	—6	—9	—11	0
436	Leather: calf	—11	—9	—2	+1	+1	—19	+6	+14	+11	+2	+11	—2	—2	+7	—3	—21	—17	—2	+4	—6	+1
438	Leather: harness oak	+3	+15	—6	+1	+3	—1	—1	+10	+4	—5	+7	—1	—2	C	—4	+1	0	—8	+3	—6	+2
440	Leather: sole oak	0	+9	—1	+1	—12	+1	—8	—7	+2	+2	+5	0	0	+10	+7	—18	—10	+2	0	—10	+4
441	Leather: sole oak, scoured backs	+9	+12	0	—1	—6	—2	—2	—8	0	—9	*—7	+2	—4	R	R	—9	—3	—9	+4	+3	+1
443	Paper: newsprint	S	S	S	S	+29	+1	+3	+5	+25	+9	+26	+10	+10	*+25	+13	—15	—11	+6	+3	+14	C
444	Paper: wrapping, Manila	+3	+7	—15	+27	+11	R	R	+23	+28	+5	C	C	—1	+18	+15	+5	+4	+4	—3	R	R
448	Jute	—9	—1	—4	+13	+21	+5	+4	+10	—7	—10	+16	+14	+3	+4	+1	+1	+2	—7	—1	—3	—8
450	Rope	—7	—3	+5	+1	+5	—4	—8	—3	—17	—2	+26	+7	+8	—1	+5	+2	+8	+5	—6	+3	—4
451	Rubber	—8	0	—7	+1	—15	0	+13	R	R	—28	+1	+1	+1	—17	0	0	+4	—6	+2	—2	0
455	Starch: laundry	+9	+2	+2	—2	—7	R	R	+3	+17	R	R	—8	+1	+1	—3	—13	—6	+8	C	C	—4
456	Tobacco: plug	+8	C	C	+6	0	*+15	+14	C	C	—14	C	+8	C	C	+1	R	R	+9	C	C	C
457	Tobacco: smoking	C	C	C	C	+13	C	C	R	R	C	C	—1	—6	C	+25	R	R	C	C	+9	C

TABLE XI

Measures Describing Cyclical Movements in the Wholesale Prices of 24 Representative Commodities
1890-1925

(1) Periods	(2) Deviation of *low* from reference date[1]	(3) Deviation of *high* from reference date[1]	(4) Duration of rise	(5) Duration of fall	(6) Duration of cycle low to low	(7) Percentage Change: Rise as per cent of preceding low	(8) Percentage Change: Rise as per cent of ensuing high	(9) Percentage Change: Fall as per cent of preceding high	(10) Index of cyclical variability $\frac{(8)+(9)}{2}$
	mos.	mos.	mos.	mos.	mos.				
13 Cattle: steers, choice to prime									
1- 2	+ 1	0	8	15	23	26.7	21.1	23.5	22.3
3- 4	—10	— 6	11	13	24	36.1	26.5	30.4	28.4
5- 6	—12	— 6	41	6	47	58.4	36.9	16.4	26.6
7- 8	—15	— 2	28	11	39	47.9	32.4	35.6	34.0
9-10	—12	— 3	48	7	55	32.0	24.2	17.6	20.9
11-12	0	+ 2	28	11	39	44.5	30.8	25.3	28.0
13-14	— 1	+12	40	7	47	68.6	40.7	20.8	30.7
15-16	+ 5	+ 4	45	5	50	138.9	58.2	20.0	39.1
17-18	+ 4	— 6	5	19	24	20.4	17.0	55.3	36.1
19-20	— 7	— 5	17	5	22	47.0	32.0	22.2	27.1
21	—14								
Averages[2]	— 5.5	— 1.0 — 1.5	27.1	9.9	37.0	52.0	32.0	26.7	29.3
16 Hogs: light									
1- 2	— 5	0	14	24	38	117.4	54.0	50.1	52.0
3- 4	— 1	— 3	5	14	19	29.3	22.7	36.5	29.6
5- 6	— 8	0	43	8	51	72.5	42.0	12.2	27.1
7- 8	— 7	— 1	21	27	48	56.1	36.0	41.1	38.5
9-10	+ 5	— 8	26	12	38	56.4	36.1	38.8	37.4
11-12	0	— 1	25	14	39	143.2	58.9	42.6	50.7
13-14	— 1	— 2	26	29	55	53.6	34.9	32.0	33.4
15-16	+13	0	33	4	37	221.4	68.9	13.2	41.0
17-18	— 1	—10	6	28	34	28.6	22.2	69.3	45.7
19-20	— 2	— 9	8	17	25	55.7	35.8	34.9	35.3
21	— 6								
Averages	— 1.2	— 3.4 — 3.8	20.7	17.7	38.4	83.4	41.1	37.1	39.1

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[1] (The figures in columns (2) and (3) indicate the number of months by which the price turns of specific commodities precede (—) or lag behind (+) the major turns of the general price index. The symbols I. C., C, S and R represent, respectively, irregularly constant, constant, sagging and rising prices. The dates of the reference points are given on page 81 of the text. For a detailed explanation of the method employed and for an explanation of the periods, see text pp. 78-82.

[2] For explanation of the second set of averages see points 3 and 5, pages 89-90.

TABLE XI (Cont.)

(1) Periods	(2) Deviation of *low* from reference date	(3) Deviation of *high* from reference date	(4) Duration of rise	(5) Duration of fall	(6) Duration of cycle low to low	(7) Percentage Change	(8)	(9)	(10) Index of cyclical variability $\frac{(8)+(9)}{2}$
						Rise as per cent of preceding low	Rise as per cent of ensuing high	Fall as per cent of preceding high	
	mos.	mos.	mos.	mos.	mos.				
17 Sheep: western ewes									
1– 2	— 9	—10	8	30	38	51.0	33.8	63.6	48.7
3– 4	— 5	— 7	5	8	13	76.1	43.2	35.3	39.2
5– 6	—18	0	53	19	72	132.9	57.1	46.3	51.7
7– 8	+ 4	— 5	6	18	24	76.2	43.3	49.4	46.3
9–10	— 8	— 6	41	8	49	107.8	51.9	41.2	46.5
11–12	— 2	— 1	27	17	44	118.0	54.1	56.7	55.4
13–14	+ 2	— 5	20	4	24	83.0	45.4	32.9	39.1
15–16	—15	— 5	56	17	73	283.9	74.0	52.7	63.3
17–18	+ 7	— 1	7	14	21	101.4	50.4	81.1	65.7
19–20	— 7	0	22	2	24	181.4	64.5	36.4	50.4
21	—12								
Averages	— 5.7	— 4.0 — 3.9	24.5	13.7	38.2	121.2	51.8	49.6	50.7
25 Cotton									
1– 2	— 2	— 2	9	26	35	41.7	29.4	42.3	35.8
3– 4	— 1	0	8	37	45	63.3	38.8	40.9	39.8
5– 6	+18	+ 5	22	14	36	93.5	48.3	23.9	36.1
7– 8	+ 4	+17	28	10	38	93.7	48.4	53.7	51.0
9–10	+ 6	— 2	31	16	47	86.5	46.4	30.7	38.5
11–12	+10	+ 4	20	16	36	80.1	44.5	43.8	44.1
13–14	+ 6	+ 1	22	14	36	49.5	33.1	45.8	39.4
15–16	+ 1	0	45	5	50	371.7	78.8	26.5	52.6
17–18	0	— 1	14	11	25	61.2	38.0	72.2	55.1
19–20	—10	+ 8	33			203.4	67.0		
21	S								
Averages	+ 3.2	+ 3.0 + 3.3	23.2	16.5	38.7	114.5	47.3	42.2	44.7
42 Hides									
1– 2	+ 1	— 5	3	21	24	30.5	23.4	47.4	35.4
3– 4	— 9	— 2	14	8	22	164.1	62.1	50.5	56.3
5– 6	—13	— 4	44	7	51	108.6	52.1	24.4	38.2
7– 8	—12	— 1	26	18	44	42.7	29.9	29.5	29.7
9–10	— 4	—10	33	15	48	56.8	36.3	42.8	39.5
11–12	+ 1	— 5	20	17	37	90.7	47.6	29.2	38.4
13–14	— 2	—10	19	6	25	56.9	36.3	16.9	26.6
15–16	—18	—10	54	4	58	112.3	52.9	25.5	39.2
17–18	—11	— 9	17	20	37	97.7	49.4	80.6	65.0
19–20	— 9	— 5	19	18	37	125.7	55.7	47.8	51.7
21	— 1								
Averages	— 7.0	— 6.1 — 5.7	24.9	13.4	38.3	88.6	44.6	39.5	42.0

TABLE XI (Cont.)

(1) Periods	(2) Deviation of *low* from reference date mos.	(3) Deviation of *high* from reference date mos.	(4) Duration of rise mos.	(5) Duration of fall mos.	(6) Duration of cycle low to low mos.	(7) Percentage Change	(8)	(9)	(10) Index of cyclical variability $\frac{(8)+(9)}{2}$
						Rise as per cent of preceding low	Rise as per cent of ensuing high	Fall as per cent of preceding high	
					47 Milk				
1–2	+ 2	0	7	16	23	62.5	38.5	43.7	41.1
3–4	— 9	+ 3	19	29	48	63.9	39.0	41.7	40.3
5–6	+13	+ 8	30	6	36	85.7	46.2	38.5	42.3
7–8	— 1	+ 2	18	30	48	87.5	46.7	46.7	46.7
9–10	+11	+14	42	6	48	100.0	50.0	43.8	46.9
11–12	+16	+ 8	18	6	24	88.9	47.1	41.2	44.1
13–14	0	— 9	18	17	35	70.0	41.2	37.4	39.3
15–16	— 6	+ 3	55	4	59	245.9	71.1	28.3	49.7
17–18	+ 2	+19	32	6	38	34.8	25.9	39.3	32.6
19–20	+ 5	+ 6	16	9	25	55.5	35.7	32.2	33.9
21	+ 1								
Averages	+ 3.1	+ 5.4 + 5.7	25.5	12.9	38.4	89.5	44.1	39.3	41.7
					56 Wool				
1–2	0	+ 2	11	26	37	10.0	9.1	47.1	28.1
3–4	+ 3	+ 6	10	5	15	18.7	15.8	10.5	13.1
5–6	— 8	— 2	41	16	57	105.9	51.4	30.0	40.7
7–8	— 1	R	51		121	46.9	32.0		
9–10	R	—25		70				23.9	27.9
11–12	S	S							
13–14	+ 1	—13	13	17	30	14.3	12.5	20.3	16.4
15–16	—10	+ 3	59	1	60	218.3	68.6	19.4	44.0
17–18	— 1	— 1	15	18	33	51.8	34.1	65.8	49.9
19–20	— 3	+ 1	19	13	32	92.9	48.2	24.1	36.1
21	0								
Averages	— 2.1	— 3.6 — 4.6	27.4 24.0	20.7 13.7	48.1 37.7	69.8 73.1	34.0 34.2	30.1 31.0	32.0 32.6
					226 Silk: raw, Japanese, Kansai No. 1				
1–2	— 7	+ 2	18	14	32	38.5	27.8	39.3	33.5
3–4	— 9	+ 1	17	6	23	28.8	22.4	24.4	23.4
5–6	—12	— 4	43	14	57	75.1	42.9	39.6	41.2
7–8	— 5	+ 5	25	16	41	29.4	22.7	18.2	20.4
9–10	0	— 5	34	12	46	60.4	37.7	38.1	37.9
11–12	+ 3	—13	10	32	42	22.4	18.3	22.9	20.6
13–14	+ 5	— 1	21	16	37	23.7	19.2	29.3	24.2
15–16	+ 1	+ 2	47	2	49	144.0	59.0	18.7	38.8
17–18	— 1	— 4	12	6	18	199.1	66.6	72.9	69.7
19–20	—18	+ 5	38	8	46	112.7	53.0	51.0	52.0
21	— 1								
Averages	— 4.0	— 1.2 — 1.6	26.5	12.6	39.1	73.4	37.0	35.4	36.2

TABLE XI (Cont.)

(1) Periods	(2) Deviation of *low* from reference date	(3) Deviation of *high* from reference date	(4) Duration of rise	(5) Duration of fall	(6) Duration of cycle low to low	(7) Percentage Change Rise as per cent of preceding low	(8) Percentage Change Rise as per cent of ensuing high	(9) Percentage Change Fall as per cent of preceding high	(10) Index of cyclical variability $\frac{(8)+(9)}{2}$
	mos.	mos.	mos.	mos.	mos.				
233 Anthracite coal									
1– 2	— 3	— 4	8	35	43	40.4	28.8	41.4	35.1
3– 4	+ 6	+13	14	14	28	46.6	31.8	14.6	23.2
5– 6	+ 8	+10	37	14	51	32.0	24.2	11.4	17.8
7– 8	+ 9	I. C.							
9–10	I. C.	I. C.							
11–12	I. C.	I. C.							
13–14	+ 1	I. C.							
15–16	+13	R							
17–18	R	R							
19–20	I. C.	R							
21	I. C.								
Averages	+ 5.7	+ 6.3 + 6.3	19.7	21.0	40.7	39.7	28.3	22.5	25.4
237 Bituminous Coal									
1– 2	—14	+13	36	15	51	18.8	15.8	21.1	18.4
3– 4	+ 3	+16	20	13	33	26.7	21.1	15.8	18.4
5– 6	+10	Strike	55		149	525.0	84.0		
7– 8	+ 8	0		94				73.0	78.5
9–10	S	S							
11–12	+30	+11	7	10	17	11.1	10.0	6.7	8.3
13–14	+ 7	+ 3	23	8	31	21.4	17.6	13.6	15.6
15–16	— 3	—14	35	3	38	159.6	61.5	41.8	51.6
17–18	—16	+ 7	38	16	54	116.8	53.9	48.7	51.3
19–20	+ 3	— 3	9	31	40	102.3	50.6	50.1	50.3
21	+14								
Averages	+ 4.2 + 6.4	+ 4.1 + 6.7	27.9 24.0	23.7 13.7	51.6 37.7	122.7 65.2	39.3 32.9	33.8 28.2	36.5 30.5
239 Coke									
1– 2	+ 7	+ 1	3	14	17	8.6	7.9	51.6	29.7
3– 4	—10	+16	33	3	36	104.3	51.1	25.5	38.3
5– 6	0	0	35	11	46	167.9	62.7	49.9	56.3
7– 8	— 4	+ 5	24	16	40	112.8	53.0	64.2	58.6
9–10	0	— 8	31	20	51	150.3	60.1	58.1	59.1
11–12	+ 8	— 6	12	25	37	90.0	47.4	45.6	46.5
13–14	+ 5	— 8	14	22	36	137.4	57.9	57.9	57.9
15–16	0	—14	32	22	54	690.3	87.4	68.7	78.0
17–18	+ 3	+ 3	15	16	31	304.9	75.3	82.4	78.8
19–20	— 1	— 8	8	23	31	385.5	79.5	77.8	78.6
21	+ 1								
Averages	+ .8	— 1.9 — .5	20.7	17.2	37.9	215.2	58.2	58.2	58.2

TABLE XI (Cont.)

(1) Periods	(2) Deviation of *low* from reference date	(3) Deviation of *high* from reference date	(4) Duration of rise	(5) Duration of fall	(6) Duration of cycle low to low	(7) Percentage Change	(8)	(9)	(10) Index of cyclical variability $\frac{(8)+(9)}{2}$
						Rise as per cent of preceding low	Rise as per cent of ensuing high	Fall as per cent of preceding high	
	mos.	mos.	mos.	mos.	mos.				
247 Petroleum: crude									
1– 2	+ 5	+16	20	2	22	73.9	42.6	9.5	26.0
3– 4	— 7	— 6	8	33	41	121.0	54.7	63.7	59.2
5– 6	+ 8	— 1	26	15	41	158.5	61.3	37.5	49.4
7– 8	— 1	+14	30	21	51	79.4	44.3	32.6	38.4
9–10	+14	+19	44	31	75	40.2	28.7	27.0	27.8
11–12	S	S							
13–14	+ 6	+ 7	28	16	44	92.3	48.0	46.0	47.0
15–16	+ 9	R	64		72	351.9	77.9		
17–18	R	+ 7		8				63.1	70.5
19–20	— 5	— 1	19	8	27	77.8	43.7	40.2	41.9
21	— 7								
Averages	+ 2.4	+ 6.9	29.9	16.7	46.6	124.4	50.1	39.9	45.0
		+ 6.9	25.0	14.7	37.7	91.9	46.2	41.8	44.0
259 Pig iron. basic									
1– 2	+11	+ 5	3	21	24	2.9	2.8	20.0	11.4
3– 4	+ 1	0	6	33	39	20.8	17.2	22.4	19.8
5– 6	+14	— 3	18	21	39	122.2	55.0	38.0	46.5
7– 8	+ 3	+ 1	13	20	33	60.5	37.7	39.9	38.8
9–10	0	— 9	30	19	49	84.1	45.7	38.2	41.9
11–12	+ 6	— 3	17	25	42	14.7	12.8	21.3	17.0
13–14	+ 8	— 8	11	22	33	23.8	19.2	23.7	21.4
15–16	0	—14	32	27	59	320.7	76.2	51.0	63.6
17–18	+ 8	+ 4	11	17	28	88.4	46.9	63.4	55.1
19–20	+ 1	— 7	7	25	32	83.8	45.6	41.8	43.7
21	+ 4								
Averages	+ 5.1	— 3.4	14.8	23.0	37.8	82.2	35.9	36.0	35.9
		— 2.2							
293 Copper: ingot									
1– 2	—2	— 1	10	17	27	16.6	14.2	27.7	20.9
3– 4	— 9	0	16	11	27	36.9	26.9	14.3	20.6
5– 6	— 8	—11	32	40	72	83.3	45.5	40.5	43.0
7– 8	+14	+ 6	7	8	15	32.1	24.3	19.0	21.6
9–10	— 7	— 5	41	23	64	108.2	52.0	49.7	50.8
11–12	+14	— 2	10	15	25	8.5	7.9	11.2	9.5
13–14	— 1	—11	17	25	42	46.3	31.6	36.4	34.0
15–16	0	—18	28	24	52	222.7	69.0	58.4	63.7
17–18	+ 1	— 9	5	24	29	51.0	33.8	48.7	41.2
19–20	— 5	0	20	15	35	44.4	30.8	26.6	28.7
21	+ 1								
Averages	— .2	— 5.1	18.6	20.2	38.8	65.0	33.6	33.2	33.4
		— 3.7							

TABLE XI (Cont.)

(1) Periods	(2) Deviation of *low* from reference date	(3) Deviation of *high* from reference date	(4) Duration of rise	(5) Duration of fall	(6) Duration of cycle low to low	(7) Percentage Change: Rise as per cent of preceding low	(8) Percentage Change: Rise as per cent of ensuing high	(9) Percentage Change: Fall as per cent of preceding high	(10) Index of cyclical variability $\frac{(8)+(9)}{2}$
	mos.	mos.	mos.	mos.	mos.				
195 Print cloths									
1– 2	— 9	— 2	16	27	43	42.6	29.9	38.6	34.2
3– 4	0	0	7	31	38	31.2	23.8	40.4	32.1
5– 6	+12	— 3	20	17	37	92.2	48.0	34.2	41.1
7– 8	— 1	+17	33	14	47	63.9	39.0	33.5	36.2
9–10	+10	0	29	11	40	97.4	49.3	42.9	46.1
11–12	+ 7	— 2	17	21	38	41.7	29.4	28.0	28.7
13–14	+ 5	— 9	13	24	37	35.0	25.9	35.3	30.6
15–16	+ 1	— 5	40	11	51	436.9	81.4	51.1	66.2
17–18	+ 1	— 1	13	15	28	157.8	61.2	73.9	67.5
19–20	— 6	+ 8	29			88.4	46.9		
21	S								
Averages	+ 2.0	+ .3 + .9	21.7	19.0	39.9	108.7	43.5	42.0	42.7
210 Suiting: Middlesex									
1– 2	C	+ 4		54				32.3	
3– 4	S	S							
5– 6	+ 7	C	120		144	63.3	38.8		
7– 8	0	R							
9–10	R	+ 2		24				7.9	23.3
11–12	+22	— 1	3	28	31	5.7	5.4	11.4	8.4
13–14	+13	— 1	13	12	25	6.1	5.7	8.6	7.1
15–16	— 3	+ 4	53	4	57	196.9	66.3	10.5	38.4
17–18	+ 3	+ 1	13	22	35	17.6	15.0	37.0	26.0
19–20	+ 3	+13	25	4	29	30.2	23.2	2.4	12.8
21	+ 3								
Averages	+ 6.0	+ 3.1 + 3.0	37.8 21.4	21.1 15.7	53.5 35.4	53.3 51.3	25.7 23.1	15.7 13.0	20.7 18.0
269 Nails: wire									
1– 2	+ 9	+ 3	3	20	23	7.5	7.0	33.1	20.0
3– 4	— 2	+13	22	25	47	119.1	54.4	57.1	55.7
5– 6	+19	0	16	55	71	144.4	59.1	48.5	53.8
7– 8	S	S							
9–10	+ 4	+ 8	43	11	54	26.5	20.9	20.9	20.9
11–12	+15	+ 3	14	17	31	14.7	12.8	17.9	15.3
13–14	+ 6	— 2	19	18	37	18.8	15.8	14.5	15.1
15–16	+ 2	—11	33	23	56	152.3	60.4	18.3	39.3
17–18	+ 7	— 3	5	29	34	37.3	27.2	45.7	36.4
19–20	+ 6	+12	21	7	28	24.0	19.4	8.1	13.7
21	+ 5								
Averages	+ 7.1	+ 2.6 + 4.2	19.6 19.6	22.8 18.7	42.3 38.7	60.5 60.5	30.8 30.8	29.3 26.9	30.0 28.8

TABLE XI (Cont.)

(1) Periods	(2) Deviation of *low* from reference date	(3) Deviation of *high* from reference date	(4) Duration of rise	(5) Duration of fall	(6) Duration of cycle low to low	(7) Percentage Change: Rise as per cent of preceding low	(8) Percentage Change: Rise as per cent of ensuing high	(9) Percentage Change: Fall as per cent of preceding high	(10) Index of cyclical variability $\frac{(8)+(9)}{2}$
	mos.	mos.	mos.	mos.	mos.				
296 Lead: pig									
1– 2	+ 7	+ 2	4	21	25	8.8	8.1	25.2	16.6
3– 4	— 2	— 2	7	13	20	17.4	14.8	23.5	19.1
5– 6	— 8	+ 1	44	20	64	72.6	42.1	15.4	28.7
7– 8	+ 6	+ 6	15	5	20	16.8	14.3	12.0	13.1
9–10	—10	— 7	42	10	52	55.2	35.6	42.0	38.8
11–12	— 1	— 3	24	26	50	27.8	21.8	15.4	18.6
13–14	+ 9	—11	7	25	32	27.5	21.6	31.4	26.5
15–16	0	—15	31	23	54	228.5	69.6	55.7	62.6
17–18	+ 3	— 2	10	12	22	80.4	44.6	55.4	50.0
19–20	—10	+12	37	3	40	126.8	55.9	23.7	39.8
21	+ 1								
Averages	— .5	— 1.9 — .4	22.1	15.8	37.9	66.2	32.8	30.0	31.4
300 Tin: pig									
1– 2	— 4	— 8	5	33	38	9.1	8.4	38.9	23.6
3– 4	0	+ 1	8	11	19	10.9	9.8	12.9	11.3
5– 6	— 7	— 1	41	22	63	169.7	62.9	33.6	48.2
7– 8	+ 6	+ 5	14	16	30	35.4	26.2	16.6	21.4
9–10	0	— 5	34	8	42	67.5	40.3	37.8	39.0
11–12	— 1	+14	41	4	45	80.4	44.6	16.8	30.7
13–14	+ 4	— 8	15	21	36	25.7	20.4	38.5	29.4
15–16	— 1	— 4	43	18	61	224.6	69.2	46.0	57.6
17–18	+ 9	— 4	2	19	21	17.1	14.6	58.1	36.3
19–20	— 5	+10	30	4	34	98.1	49.5	19.3	34.4
21	0								
Averages	+ .1	0 + .4	23.3	15.6	38.9	73.8	34.6	31.8	33.2
166 Shoes: men's									
1– 2	C	C							
3– 4	C	C							
5– 6	C	C							
7– 8	— 7	R	72		96	20.1	16.7		
9–10	C	—10		24				3.8	10.2
11–12	+10	0	16	24	40	8.9	8.2	1.6	4.9
13–14	+10	R	97		128	220.0	68.7		
15–16	R	R							
17–18	R	0		31				33.9	51.3
19–20	+11	— 3	1	23	24	3.1	3.1	4.6	3.8
21	+ 6								
Averages	+ 6.0	— 3.3 — 3.3	46.5 8.5	25.5 25.5	72.0 32.0	63.0 6.0	24.2 5.7	11.0 11.0	17.6 8.3

TABLE XI (Cont.)

(1) Periods	(2) Deviation of *low* from reference date	(3) Deviation of *high* from reference date	(4) Duration of rise	(5) Duration of fall	(6) Duration of cycle low to low	(7)	(8)	(9)	(10) Index of cyclical variability $\frac{(8)+(9)}{2}$
						Percentage Change			
						Rise as per cent of preceding low	Rise as per cent of ensuing high	Fall as per cent of preceding high	
	mos.	mos.	mos.	mos.	mos.				
276 Steel billets									
1– 2	+ 9	+ 2	2	21	23	5.4	5.1	34.9	20.0
3– 4	— 2	— 1	8	20	28	64.6	39.3	42.7	41.0
5– 6	0	— 6	29	12	41	197.3	66.4	59.5	62.9
7– 8	— 9	— 4	20	28	48	92.7	48.1	39.8	43.9
9–10	+ 3	— 5	31	26	57	55.4	35.6	24.1	29.8
11–12	+17	— 1	8	21	29	19.6	16.4	30.0	23.2
13–14	+ 6	— 5	16	20	36	48.1	32.5	33.3	32.9
15–16	+ 1	—14	31	27	58	426.3	81.0	61.5	71.2
17–18	+ 8	+ 2	9	20	29	62.3	38.4	55.2	46.8
19–20	+ 2	0	13	19	32	60.7	37.8	21.1	29.4
21	+ 5								
Averages	+ 3.6	— 3.2 — 2.0	16.7	21.4	38.1	103.2	40.1	40.2	40.1
280 Steel rails									
1– 2	—17	— 2	24	30	54	5.3	5.0	26.7	15.8
3– 4	+ 3	+14	18	23	41	27.3	21.4	39.3	30.3
5– 6	+18	+ 4	21	8	29	105.9	51.4	25.7	38.5
7– 8	— 3	C	214		224	111.5	52.7		
9–10	C	C							
11–12	C	C							
13–14	C	C							
15–16	+18	+ 5		10				18.2	35.4
17–18	+10	+ 6	11	22	33	16.7	14.3	23.8	19.0
19–20	+ 8	C				7.5	7.0		
21	C								
Averages	+ 5.3	+ 5.2 + 5.5	57.6 18.5	18.6 18.6	76.2 39.2	45.7 32.5	25.3 19.8	26.7 26.7	26.0 23.2
297 Lead pipe									
1– 2	S	S							
3– 4	C	C							
5– 6	— 4	+ 1	40	8	48	55.6	35.7	17.4	26.5
7– 8	— 6	+ 6	27	16	43	23.2	18.9	20.0	19.4
9–10	+ 1	— 5	33	10	43	57.9	36.7	41.0	38.8
11–12	+ 1	— 1	24	27	51	28.5	22.2	10.3	16.2
13–14	+12	—11	4	27	31	20.0	16.7	25.0	20.8
15–16	+ 2	—14	30	22	52	194.6	66.1	50.4	58.2
17–18	+ 3	+ 3	15	12	27	64.6	39.3	51.5	45.4
19–20	— 5	0	20	3	23	85.8	46.2	13.3	29.7
21	—11								
Averages	— .8	— 2.6 — 1.0	24.1	15.6	39.7	66.3	35.2	28.6	31.9

TABLE XI (Conc.)

(1) Periods	(2) Deviation of *low* from reference date mos.	(3) Deviation of *high* from reference date mos.	(4) Duration of rise mos.	(5) Duration of fall mos.	(6) Duration of cycle low to low mos.	(7) Percentage Change Rise as per cent of preceding low	(8) Percentage Change Rise as per cent of ensuing high	(9) Percentage Change Fall as per cent of preceding high	(10) Index of cyclical variability $\frac{(8)+(9)}{2}$
441 Leather: sole oak, scoured backs									
1– 2	+ 9	+12	12	13	25	2.9	2.9	17.1	10.0
3– 4	0	— 1	6	14	20	36.2	26.6	27.8	27.2
5– 6	— 6	— 2	39	15	54	35.1	26.0	13.0	19.5
7– 8	— 2	— 8	9	29	38	16.4	14.1	16.7	15.4
9–10	0	— 9	30	6	36	24.6	19.8	9.9	14.8
11–12	— 7	+ 2	35	8	43	19.2	16.1	12.6	14.3
13–14	— 4	R	82		93	121.1	54.8		
15–16	R	— 9		11				8.3	31.5
17–18	— 3	— 9	9	33	42	33.8	25.2	51.5	38.3
19–20	+ 4	+ 3	14	12	26	8.0	7.4	21.3	14.3
21	+ 1								
Averages	— .8	— 2.3 — 1.5	26.2 19.2	15.7 15.7	41.9 35.5	33.0 22.0	21.4 17.3	19.8 19.8	20.6 18.5

Because of the presence of measures relating to periods of rise without corresponding measures for period of decline (or vice versa) the sum of averages of the figures in columns (4) and (5) is not in all case equal to the average of the figures in column (6).

TABLE XII

MEASURES DESCRIBING THE BEHAVIOR OF WHOLESALE COMMODITY PRICES DURING PERIODS OF REVIVAL AND RECESSION IN AMERICAN BUSINESS, 1890-1925

Averages relating to Timing, Duration and Amplitude of Cyclical Movements.[1]

(1) Ref. No.	(2) Commodity	(3) No. of cycles observed	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21) Index of cyclical variability
			Behavior during revival						Behavior during recession						Average duration of			Av. percentage of		
			Constant	Sagging	Rising	Turns observed	Av. time as a deviation in months from the reference date	Av. percentage of rise based on preceding low value	Constant	Sagging	Rising	Turns observed	Av. time as a deviation in months from the reference date	Av. percentage of fall based on preceding high value	Rise in mos.	Fall in mos.	Cycle in mos.	Rise based on ensuing high value	Fall based on preceding high value	
1	*Barley	10				11	— 5.5	91.9				10	— 6.4 — 6.4	39.9	22.1	15.2	37.3	41.9	39.9	40.9
2	*Corn	9			1	10	— 1.0	88.0			1	9	— 4.7 — 3.7	40.0	20.4	19.2	39.7	43.1	40.0	41.5
4	*Oats	9			1	10	— 3.3	97.3			1	9	— 6.6 — 6.6	44.1	22.2	19.0	41.2	44.8	44.1	44.4
5	*Rye	8	1	1		9	— 9.6	96.8 96.8	1	1		8	—10.2 —10.9	39.4 42.6	24.0 24.0	20.7 18.6	44.7 37.9	40.6 40.6	39.4 42.6	40.0 41.6
6	*Wheat	6		3	1	7	—13.4	114.5 120.7		3	1	6	—16.3 —16.4	41.0 35.6	34.8 29.6	22.0 18.8	56.8 49.7	47.1 47.5	41.0 35.6	44.0 41.5
13	Cattle: choice to prime	10				11	— 5.5	52.0				10	— 1.0 — 1.5	26.7	27.1	9.9	37.0	32.0	26.7	29.3
14	Cattle: good to choice	10				11	— 1.8	48.1				10	0 — .7	24.3	25.7	13.2	38.9	30.2	24.3	27.2
15	Hogs: heavy	10				11	— 2.5	83.4				10	— 3.8 — 4.2	36.9	21.2	17.6	38.8	41.1	36.9	39.0
16	Hogs: light	10				11	— 1.2	83.4				10	— 3.4 — 3.8	37.1	20.7	17.7	38.4	41.1	37.1	39.1
17	Sheep: ewes	10				11	— 5.7	121.2				10	— 4.0 — 3.9	49.6	24.5	13.7	38.2	51.8	49.6	50.7
19	Sheep: wethers	10				11	— 6.7	110.0				10	— 4.9 — 4.9	47.3	24 8	13.2	38.0	49.0	47.3	48.1

22	*Beans	10				11	−1.9	100.6				10	−7.1 −6.2	39.8	18.3	20.1	38.4	40.6	39.8	40.2
25	Cotton	9½		1		10	+3.2	114.7				10	+3.0 +3.3	42.2	23.2	16.5	38.7	47.3	42.2	44.7
31	*Eggs	8			2	9	−1.0	175.7 146.0			2	8	+2.2 +2.2	58.9 58.9	34.7 24.0	13.2 13.2	48.0 36.2	62.3 59.0	58.9 58.9	60.6 58.9
34	*Flaxseed	8			2	9	−6.3	118.5 82.6			2	8	−5.9 −6.4	42.7 42.7	34.5 25.2	14.9 14.9	49.4 39.3	48.5 41.6	42.7 42.7	45.6 42.1
37	*Hay	8		1	1	9	+8.7	78.7 76.5		1	1	8	+3.1 +3.6	35.6 35.6	24.7 21.7	22.1 22.1	46.9 40.9	40.9 39.8	35.6 35.6	38.2 37.7
42	Hides	10				11	−7.0	88.6				10	−6.1 −5.7	39.5	24.9	13.4	38.3	44.6	39.5	42.0
44	*Hops	8		2		9	+ .9	264.0 264.0		2		8	−3.9 −2.9	64.9 60.5	20.1 20.1	27.4 21.8	47.5 44.3	65.8 65.8	64.9 60.5	65.3 63.1
47	Milk	10				11	+3.1	89.5				10	+5.4 +5.7	39.3	25.5	12.9	38.4	44.1	39.3	41.7
49	*Onions	10				11	−5.9	648.3				10	−11.9 −11.1	78.1	17.0	20.4	37.4	76.7	78.1	77.4
51	*Potatoes	10				11	+2.9	357.5				10	+2.2 +4.1	70.6	22.8	16.3	39.1	72.2	70.6	71.4
53	Rice	9	1			10	−4.1	51.4 51.4		1		9	−3.7 −4.0	27.9 27.8	23.1 23.1	20.4 18.6	43.6 39.6	30.8 30.8	27.9 27.8	29.3 29.3
56	Wool: fine clothing	8		1	1	9	−2.1	69.8 73.1		1	1	8	−3.6 −4.6	30.1 31.0	27.4 24.0	20.7 13.7	48.1 37.7	34.0 34.2	30.1 31.0	32.0 32.6
59	Wool: medium	8		1	1	9	− .7	73.2 78.6		1	1	8	−5.5 −5.6	26.5 26.5	26.0 22.9	17.5 17.5	43.5 37.7	33.1 34.1	26.5 26.5	29.8 30.3
64	Beef: fresh	10				11	+ .3	46.6				10	+ .8 +1.2	25.3	24.4	14.5	38.9	30.2	25.3	27.7
68	Beef: salt	9			1	10	+1.9	64.6 58.7			1	9	+1.9 +1.9	29.9 29.9	25.3 23.1	16.1 16.1	41.4 36.1	37.3 35.4	29.9 29.9	33.6 32.6

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[1] A second average appearing in col. (8) is based upon all entries except that for period (17). The entry for this period has been excluded if the commodity in question was affected by Federal price regulation at this time.

The second averages in col. (14) are based upon all entries except those for period (16).

A second average appearing in any other column is based upon entries relating to successive periods only. In its computation account has been taken only of those periods during which the given commodity conformed to the general price movements. A line in place of a second entry means that there was no case in which successive turns were recorded.

*The commodities marked with an asterisk have price movements which are irregular, in the sense that they do not conform in any systematic fashion to the cyclical movement of general prices. For a more detailed explanation see *text*, pp. 81, 102.

TABLE XII (Cont.)

(1) Ref. No.	(2) Commodity	(3) No. of cycles observed	(4) Behavior during revival: Constant	(5) Sagging	(6) Rising	(7) Turns observed	(8) Av. time as a deviation in months from the reference date	(9) Av. percentage of rise based on preceding low value	(10) Behavior during recession: Constant	(11) Sagging	(12) Rising	(13) Turns observed	(14) Av. time as a deviation in months from the reference date	(15) Av. percentage of fall based on preceding high value	(16) Average duration of: Rise in mos.	(17) Fall in mos.	(18) Cycle in mos.	(19) Av. percentage of: Rise based on ensuing high value	(20) Fall based on preceding high value	(21) Index of cyclical variability
69	Hams	10				11	+ 1.1	60.4				10	+ 2.1 + 1.1	30.1	23.9	15.8	39.7	34.3	30.1	32.2
71	Mutton	10				11	— .1	102.8				10	+ 1.2 + 1.8	46.6	25.1	14.4	39.5	48.8	46.6	47.7
74	Pork: cured, salt mess	10				11	— 1.7	79.8				10	— 4.6 — 4.6	34.3	21.1	17.0	38.1	38.8	34.3	36.5
75	Pork: cured, rough sides	9		1		10	— 4.8	92.5 92.5		1		9	— 6.0 — 5.4	39.7 36.5	24.3 24.3	19.9 17.0	44.2 41.4	44.7 44.7	39.7 36.5	42.2 40.6
76	Pork: cured, short clear sides	9		1		10	— 5.2	90.5 90.5		1		9	— 5.6 — 4.9	38.8 35.7	24.9 24.9	19.0 16.1	43.9 41.1	44.0 44.0	38.8 35.7	41.4 39.8
89	*Butter: creamery extra, N. Y.	10				11	— 2.7	77.3				10	— 2.7 — 3.3	37.6	24.0	15.8	39.8	41.9	37.6	39.7
90	*Butter: creamery firsts, N. Y.	10				11	— 2.5	72.0				10	— 3.2 — 3.9	35.8	23.3	16.6	39.9	39.8	35.8	37.8
95	*Butter: creamery extra. St. Louis	10				11	— 2.7	80.3				10	— 2.7 — 3.3	38.2	24.0	15.8	39.8	42.7	38.2	40.4
99	*Cheese	10				11	— 4.5	71.1				10	— 3.3 — 4.0	34.9	24.9	14.4	39.3	37.8	34.9	36.3
104	Bread: Cincinnati	2½	6		1	4	+ 7.0	84.1 43.5	6		1	3	+ 3.3 +10.0	31.9 22.5	67.5 32.0	59.0 4.0	94.5 —	42.9 30.3	31.9 22.5	37.4 26.4
106	Bread: New York	4½	5			6	+ 7.2	43.9 34.3	5			5	+ 6.8 + 8.7	14.8 14.8	45.5 18.0	12.0 12.0	58.7 30.0	27.4 22.5	14.8 14.8	21.1 18.6
109	Coffee	10				11	+ 1.8	78.9				10	— .6 + .1	37.6	19.9	17.7	37.6	37.8	37.6	37.7

111	Crackers: oyster	5½	3	1		7	+ 3.1	55.0 59.1	4			6	+ 5.9 + 5.8	15.7 12.5	40.6 27.5	21.7 10.7	65.8 45.3	31.3 32.1	15.7 12.5	23.5 22.3
112	Crackers: soda	6	2	1		8	+ 4.9	41.4 46.4	3	1		6	+ 3.2 + 2.6	17.5 15.3	32.2 20.8	24.0 11.2	56.2 34.0	23.8 25.7	17.5 15.3	20.6 20.5
113	Cod	8½		1	1	9	+ 5.7	36.9 36.9		1		9	+ 2.3 + 2.0	21.8 18.5	26.7 26.7	20.9 16.7	43.5 43.5	25.3 25.3	21.8 18.5	23.5 21.9
114	Herring	7	1	1		9	+ 2.1	64.7 57.2	2	1		7	+ 1.3 + 1.3	25.6 20.9	31.4 22.5	22.1 17.4	53.6 48.2	35.1 32.2	25.6 20.9	30.3 26.5
115	Mackerel	9			1	10	+ 7.3	87.5			1	9	+ 2.6 + 2.5	43.4	20.6	21.3	41.9	40.1	43.4	41.7
116	Salmon	7			2	9	+11.9	33.2 25.6	1		2	7	+ 7.3 + 8.2	17.9 17.9	28.6 17.0	22.7 22.7	51.3 42.5	22.6 19.0	17.9 17.9	20.2 18.4
117	*Flour: rye	7		3		8	+ 3.0	98.6 98.6		3		7	+ 1.9 + 3.2	38.9 33.8	24.1 24.1	25.9 19.8	50.0 50.0	42.1 42.1	38.9 33.8	40.5 37.9
119	*Flour: wheat, winter straights	8		2		9	− 1.4	89.6 89.6		2		8	− 5.5 − 4.0	36.8 32.9	21.0 21.0	22.1 19.9	43.1 41.6	40.7 40.7	36.8 32.9	38.7 36.8
120	*Flour: wheat, standard patents	8		2		9	− 5.7	73.1 73.1		2		8	− 5.4 − 3.9	32.4 28.5	25.9 25.9	17.2 14.3	43.1 40.4	36.1 36.1	32.4 28.5	34.2 32.3
128	*Apples	9		1		10	+ 3.1	127.5 127.5		1		9	− 2.4 − 1.5	49.3 46.2	18.4 18.4	23.4 22.1	41.9 39.7	54.1 54.1	49.3 46.2	51.7 50.1
129	*Currants	9		1		10	− 3.6	123.9		1		9	−10.3 −10.7	35.2	18.4	21.4	39.9	44.5	35.2	39.8
130	Prunes	10				11	+ .9	83.7				10	− 6.3 − 5.4	43.4	16.2	22.9	39.1	42.3	43.4	42.8
131	Raisins	7		1	2	8	+ 4.9	91.8 66.2		1	2	7	+ 5.4 + 5.4	42.8 38.0	34.1 26.2	20.9 17.5	55.0 42.8	42.6 38.0	42.8 38.0	42.7 38.0
138	Lard	8		1	1	9	− 2.6	105.2 91.2		1	1	8	− 4.1 − 3.3	39.9 35.5	28.9 22.4	21.0 18.0	49.9 40.0	45.9 42.8	39.9 35.5	42.9 39.1
139	Meal: corn, fine white	9		1		10	− 6.0	84.3		1		9	− 4.1 − 3.0	35.6	27.4	12.9	40.3	39.9	35.6	37.7
140	Meal: corn, yellow table	9		1		10	− 6.3	87.0		1		9	− 2.8 − 2.6	34.3	29.1	11.2	40.3	41.0	34.3	37.6
141	Molasses	7			3	8	+ 8.2	65.5 48.4			3	7	+ 5.1 + 5.1	28.6 28.6	30.6 22.8	23.7 23.7	54.3 45.8	34.0 28.0	28.6 28.6	31.3 28.3
145	Pepper	8		1	1	9	− 1.6	75.3 72.6		1	1	8	− 2.7 − 2.7	32.7 29.6	25.1 23.1	22.6 15.4	47.7 42.0	34.6 32.6	32.7 29.6	33.6 31.1

TABLE XII (Cont.)

(1) Ref. No.	(2) Commodity	(3) No. of cycles observed	(4) Behavior during revival	(5)	(6)	(7)	(8)	(9)	(10) Behavior during recession	(11)	(12)	(13)	(14)	(15)	(16) Average duration of	(17)	(18	(19) Av. percentage of	(20)	(21) Index of cyclical variability
			Constant	Sagging	Rising	Turns observed	Av. time as a deviation in months from the reference date	Av. percentage of rise based on preceding low value	Constant	Sagging	Rising	Turns observed	Av. time as a deviation in months from the reference date	Av. percentage of fall based on preceding high value	Rise in mos.	Fall in mos.	Cycle in mos.	Rise based on ensuing high value	Fall based on preceding high value	
146	*Salt	8	1		1	9	+ 4.2	64.8 45.2	1		1	8	+ 3.5 + 3.5	24.3 24.3	28.4 21.7	17.5 17.5	45.9 38.4	33.2 28.4	24.3 24.3	28.7 26.3
148	Starch: corn	4½	4		1	6	+ 3.2	39.5 35.0	3		1	6	+ 2.0 + 5.0	19.0 15.4	51.5 9.5	29.4 17.2	86.2 51.0	26.8 23.1	19.0 15.4	22.9 19.2
149	*Sugar: raw	9		1		10	+ 4.1	93.1 93.1		1		9	+ 6.0 + 8.4	40.4 39.3	26.2 26.2	18.1 16.6	44.3 42.1	43.7 43.7	40.4 39.3	42.0 41.5
150	*Sugar: granulated	9		1		10	+ 4.0	72.7 72.7		1		9	+ 6.9 + 9.0	33.5 32.2	27.2 27.2	17.7 16.1	44.9 42.7	37.2 37.2	33.5 32.2	35.3 34.7
152	*Tea	9				11	+ 2.2	25.5	1			9	— 4.4 — 5.6	17.3	16.9	21.9	38.8	19.1	17.3	18.2
158	Cottonseed oil	10				11	— .5	103.6				10	— 1.2 — .6	38.8	22.6	15.9	38.5	45.2	38.8	42.0
161	*Vinegar	8½	2			9	+10.0	63.5 63.5				10	+ 2.4 + 2.4	29.5 29.8	20.9 20.9	24.8 18.4	39.2 39.2	31.0 31.0	29.5 29.8	30.2 30.4
166	Men's shoes: black calf	4	4		2	5	+ 6.0	63.0 6.0	3		3	4	— 3.3 — 3.3	11.0 11.0	46.5 8.5	25.5 25.5	72.0 32.0	24.2 5.7	11.0 11.0	17.6 8.3
173	Men's shoes: chocolate elk	7		1	2	8	+ 4.1	25.4 14.0		1	2	7	— 2.4 — 2.4	14.9 14.9	28.3 15.2	22.7 22.7	51.0 36.7	16.6 11.3	14.9 14.9	15.7 13.1
174	Men's shoes: vici kid	2	4	1	3	3	+ 2.3	89.9 4.3	5	1	2	2	+ 1.5 + 1.5	20.3 20.3	91.0 —	17.5 17.5	108.5 —	35.3 4.2	20.3 20.3	27.8 12.2
177	Women's shoes	5		1	4	6	+ 7.8	54.7 14.1		1	4	5	— 2.2 — 2.2	14.8 14.8	40.8 13.3	26.6 26.6	67.4 39.3	25.0 12.2	14.8 14.8	19.9 13.5
179	Calico	9	1			10	+ 6.0	64.9 64.9	1			9	+ 1.2 + 2.0	25.7 25.7	19.0 19.0	24.4 19.7	43.4 39.6	26.8 26.8	25.7 25.7	26.2 26.2

180	Denims	9½		1		10	+ 5.0	55.6				10	+ 5.5 + 6.7	24.2	23.9	15.8	39.2	27.9	24.2	26.0
181	Drillings: Pepperell	9½		1		10	+ 8.3	60.3				10	+ 4.8 + 5.9	23.4	19.9	19.4	38.3	29.4	23.4	26.4
182	Drillings: Mass D	9½		1		10	+ 1.7	74.2				10	+ 4.1 + 4.8	26.4	25.8	13.4	38.9	32.6	26.4	29.5
183	Flannel: colored	7½		3		8	+ 7.6	96.3		2		8	+ 7.4 + 8.7	31.7	27.0	12.0	38.1	37.6	31.7	34.6
184	Flannel: unbleached	8½		2		9	+ 8.1	73.3		1		9	+10.1 +11.0	26.7	27.0	11.6	38.5	32.6	26.7	29.6
185	Ginghams: Amoskeag	10				11	+ 4.8	45.6				10	+ 6.1 + 6.4	22.3	25.0	16.0	41.0	25.3	22.3	23.8
186	Ginghams: Lancaster	9	2			9	+ 4.3	50.3				10	+ 4.7 + 4.9	20.7	25.8	14.9	38.8	26.1	20.7	23.4
190	Muslin: Fruit of the Loom	10				11	+ 1.5	57.6				10	+ 5.4 + 5.7	25.3	26.3	11.9	38.2	30.2	25.3	27.7
191	Muslin: Lonsdale	10				11	+ 4.9	58.2				10	+ 5.7 + 6.0	25.8	23.8	14.2	38.0	29.5	25.8	27.6
192	Muslin: Rough Rider	10				11	+ 6.3	51.6				10	+ 4.5 + 4.8	23.4	20.0	16.8	36.8	24.9	23.4	24.1
193	Muslin: Wamsutta	9	1			10	+ 9.9	44.3	1			9	+6.4 +7.4	17.5	20.8	18.8	39.6	21.7	17.5	19.6
195	Print cloths	9½		1		10	+ 2.0	108.7				10	+ .3 + .9	42.0	21.7	19.0	39.9	43.5	42.0	42.7
196	Sheetings: 4-4 Indian Head	9½		1		10	+ 8.3	63.7				10	+ 8.1 + 9.2	24.3	23.2	16.6	39.0	28.6	24.3	26.4
197	Sheetings: 4-4 Pepperell	10				11	+ 6.8	68.3				10	+ 5.2 + 6.3	27.0	22.5	17.5	40.0	31.0	27.0	29.0
198	Sheetings: 4-4 Ware Shoals	9				10[2]	+ 5.3	93.0 96.7				10	+ 1.7 + 2.1	33.4 33.4	25.2 20.2	18.9 18.9	44.1 40.4	36.4 36.1	33.4 33.4	34.9 34.7
199	Cotton thread	3½	7			4	+20.5	64.4 69.9	6			4	+ 3.5 + 3.3	20.4 19.7	44.3 17.5	49.2 32.3	96.0 45.0	36.4 37.7	20.4 19.7	28.4 28.7
202	Cotton yarns: carded, cones 10/1	9½		1		10	+ 3.8	82.9				10	+ 3.0 + 3.7	34.8	22.6	18.3	39.9	36.8	34.8	35.8
203	Cotton yarns: carded, cones 22/1	10				11	+ 3.9	75.3				10	+ 3.5 + 4.2	32.7	23.7	17.1	40.8	34.6	32.7	33.6

TABLE XII (Cont.)

(1) Ref. No.	(2) Commodity	(3) No. of cycles observed	(4) Behavior during revival	(5)	(6)	(7)	(8)	(9)	(10) Behavior during recession	(11)	(12)	(13)	(14)	(15)	(16) Average duration of	(17)	(18)	(19) Av. percentage of	(20)	(21) Index of cyclical variability
			Constant	Sagging	Rising	Turns observed	Av. time as a deviation in months from the reference date	Av. percentage of rise based on preceding low value	Constant	Sagging	Rising	Turns observed	Av. time as a deviation in months from the reference date	Av. percentage of fall based on preceding high value	Rise in mos.	Fall in mos.	Cycle in mos.	Rise based on ensuing high value	Fall based on preceding high value	
206	Flannels: white	8		1	1	9	+ 3.7	31.4 32.4		1	1	8	+ 5.7 + 6.0	9.5 9.5	33.4 27.0	11.1 11.1	44.5 37.7	21.1 21.2	9.5 9.5	15.3 15.3
210	Suiting: Middlesex	6½	1	1	1	8	+ 6.0	53.3 51.3	1	1	1	7	+ 3.1 + 3.0	15.7 13.0	37.8 21.4	21.1 15.7	53.5 35.4	25.7 23.1	15.7 13.0	20.7 18.0
213	Underwear: shirts and drawers	3	5			6	+ 7.7	41.9 10.4	7			3	+ 6.7 + 8.5	15.0 15.0	96.0 24.0	28.7 13.0	124.7 26.0	21.3 9.2	15.0 15.0	18.1 12.1
214	Underwear: union suits	2	4		1	5[3]	+10.4	270.0 5.4	6		1	2[4]	+ 6.0 + 6.0	35.6 48.1	141.5 36.0	47.5 23.0	189.0 —	44.7 5.2	35.6 48.1	40.1 26.6
215	Broadcloth	6		1	2	7[3]	— .3	42.0 14.8		1	2	6[4]	— .3 — .3	20.5 17.1	40.5 21.5	19.5 15.2	60.0 40.3	22.6 11.1	20.5 17.1	21.5 14.1
216	French serge	7	1	1	1	8	+ .9	43.3 43.3	1	1	1	7	+ 2.6 + 2.2	21.0 16.6	30.9 30.9	23.1 16.0	54.0 46.2	25.0 25.0	21.0 16.6	23.0 20.8
217	Storm serge	8	1	1		9	— .1	48.1 48.1	1	1		8	+ 3.9 + 3.7	22.6 21.7	29.0 29.0	18.7 14.1	47.7 43.1	22.9 22.9	22.6 21.7	22.7 22.3
218	Poplar cloth	5	3	2		6	+ 9.8	49.3 49.3	3	2		5	+ 7.4 + 8.7	18.5 18.5	35.6 35.0	20.2 14.0	55.8 53.3	24.8 24.8	18.5 18.5	21.6 21.6
219	Sicilian cloth	5½	4		1	6	+ 5.8	50.4 50.4	3		1	6	+ .8 0	16.9 16.9	41.6 30.0	25.8 14.0	55.6 41.7	25.2 25.2	16.9 16.9	21.0 21.0
220	Worsted yarns: 2-32's	10				11	+ 1.9	54.5				10	— 1.5 — 1.9	24.4	19.9	18.2	38.1	26.8	24.4	25.6
221	Worsted yarns: 2-40's	9		1		10	— .5	56.6 56.6		1		9	— 1.3 — 1.6	24.1 21.9	24.7 24.7	18.7 14.5	43.3 41.5	25.6 25.6	24.1 21.9	24.8 23.7
223	Linen shoe thread	3	4	1	1	5	+14.0	76.8 5.1	5	1	1	3	+ 8.7 + 8.7	16.4 7.3	75.0 11.0	49.7 35.0	124.7 —	26.2 4.9	16.4 7.3	21.3 6.1

226	Silk: raw, Japanese Kansai No. 1	10				11	— 4.0	73.4				10	— 1.2 — 1.6	35.4	26.5	12.6	39.1	37.0	35.4	36.2
228	Silk: raw, Japanese extra-extra	10				11	— 3.4	68.3				10	+ .1 — .1	34.4	27.1	11.9	39.0	36.3	34.4	35.3
232	Anthracite coal: broken	4	4			7	+ 8.7	19.6 13.6	4		2	4	+ 2.2 + 1.3	10.2 10.2	61.2 8.3	23.0 23.0	84.2 34.6	15.7 11.9	10.2 10.2	12.9 11.0
233	Anthracite coal: chestnut	3	4		1	6	+ 5.7	39.7	4		3	3	+ 6.3 + 6.3	22.5	19.7	21.0	40.7	28.3	22.5	25.4
234	Anthracite coal: egg	2	4		2	5	+ 1.1	33.4	4		4	2	+ 4.5 + 4.5	27.9	11.0	33.0	44.0	25.0	27.9	26.4
235	Anthracite coal: stove	2	5		1	5	+10.0	38.5	4		4	2	+ 4.5 + 4.5	36.9	11.5	31.0	42.5	27.6	36.9	32.2
236	Bituminous coal: Kanawha	9½	1			10	+10.2 +13.1	59.4				10	+ .5 + 2.2	27.4	13.7	25.2	39.9	31.2	27.5	29.3
237	Bituminous coal: New River	8		1		10	+ 4.2 + 6.4	122.7 65.2		1		8^5	+ 4.1 + 6.7	33.8 28.2	17.9 24.0	23.7 13.7	51.6 37.7	39.3 32.9	33.8 28.2	36.5 30.5
238	Bituminous coal: Pocahontas	8	2			9	+ 6.4 + 9.2	71.4 71.4	2			8	+ .7 + 3.0	32.1 34.2	16.9 16.9	31.1 21.7	48.0 39.1	33.5 33.5	32.1 34.2	32.8 33.8
239	Coke	10				11	+ .8	215.2				10	— 1.9 — .5	58.2	20.7	17.2	37.9	58.2	58.2	58.2
244	Matches	1½	9			2	+ 2.0	16.7 16.7	7		1	2	+ 6.0 + 6.0	28.6 28.6	85.0 —	81.0 7.0	240.0 —	14.3 14.3	28.6 28.6	21.4 21.4
247	Petroleum: crude	8		1	1	9	+ 2.4	124.4 91.9		1	1	8	+ 6.9 + 6.9	39.9 41.8	29.9 25.0	16.7 14.7	46.6 37.7	50.1 46.2	39.9 41.8	45.0 44.0
248	Petroleum: refined, for export	7		2	1	8	+ 4.0	67.3 40.7		2	1	7	+ 6.1 + 6.1	26.1 27.6	29.4 23.8	19.9 17.2	49.3 38.2	33.1 27.0	26.1 27.6	29.6 27 3
249	Petroleum: refined 150° fire test	7		2	1	8	+ 7.7	47.2 31.4		2	1	7	+ 6.3 + 6.3	17.9 15.6	25.3 22.7	24.0 22.5	49.3 42.6	27.7 22.6	17 9 15.6	22.8 19.1
250	Augers	4	4		2	5	+ 7.4	125.4 32.2	3		2	5	+ 7.6 + 7.6	18.3 18.3	65.0 32.5	19.5 12.7	62.7 44.5	43.8 23.0	18.3 18.3	31 0 20.6
251	Butts	7	2			9	+ 9.6	100.1 80.5	3			7	+ 7.4 + 7.3	17.2 17.2	32.0 18.5	23.1 19.0	55.1 37.5	36.4 31.0	17.2 17.2	26.8 24.1
252	Chisels	5½	3		2	6	+13.3	61.4 26.9	2		2	6	+ 6.2 + 6.2	21.6 21.6	35.8 15.0	30.2 24.4	64.8 36.0	31.2 19.0	21.6 21.6	26.4 20.3
253	Door knobs	7½	1	1		9	+ 9.6	49.4 42.7	2			8	+ 5.0 + 5.0	22.7 22.7	24.2 15.4	22.7 22.7	46.7 39.0	30.1 27.4	22.7 22.7	26.4 25.0

TABLE XII (Cont.)

(1) Ref. No.	(2) Commodity	(3) No. of cycles observed	(4) Behavior during revival	(5)	(6)	(7)	(8)	(9)	(10) Behavior during recession	(11)	(12)	(13)	(14)	(15)	(16) Average duration of	(17)	(18)	(19) Av. percentage of	(20)	(21) Index of cyclical variability
			Constant	Sagging	Rising	Turns observed	Av. time as a deviation in months from the reference date	Av. percentage of rise based on preceding low value	Constant	Sagging	Rising	Turns observed	Av. time as a deviation in months from the reference date	Av. percentage of fall based on preceding high value	Rise in mos.	Fall in mos.	Cycle in mos.	Rise based on ensuing high value	Fall based on preceding high value	
254	Files	3	3	4		4	+ 7.2	49.9 49.9	2	4	1	3	+ 5.7 + 5.5	17.1 17.2	30.3 30.3	70.3 16.0	100.7 42.5	29.5 29.5	17.1 17.2	23.3 23.3
255	Hammers	4	5		1	5	+13.6	56.5 10.4	3		3	4	+13.2 +13.2	11.1 11.1	58.7 15.5	28.7 18.3	87.5 30.0	26.4 9.4	11.1 11.1	18.7 10.2
258	Locks	8	1	1		9	+12.2	69.3 39.2	1			9	+10.6 +11.2	20.1 20.1	26.2 17.7	19.0 19.0	47.0 39.3	30.8 24.7	20.1 20.1	25.4 22.4
259	Pig iron: basic	10				11	+ 5.1	82.2				10	— 3.4 — 2.2	36.0	14.8	23.0	37.8	35.9	36.0	35.9
260	Pig iron: Bessemer	10				11	+ 3.2	79.4				10	— 2.4 — 1.1	39.2	17.3	20.7	38.0	39.4	39.2	39.3
261	Pig iron: foundry No. 2 Northern	10				11	+ 3.1	90.3				10	— 3.4 — 2.2	39.3	16.7	21.1	37.8	39.6	39.3	39.4
263	Pig iron: foundry No 2 Southern	10				11	+ 1.5	88.2				10	— 3.0 — 2.0	38.4	19.2	19.3	38.5	39.2	38.4	38.8
266	Bar iron, from store, Phila.	10				11	+ 3.5	68.3				10	0 — .3	31.9	20.1	19.1	39.2	31.9	31.9	31.9
267	Bar iron: from mill, Pitts.	10				11	+ 2.9	84.8				10	— 3.0 — 4.0	35.0	17.8	21.3	39.1	36.1	35.0	35.6
269	Nails: wire	9		1		10	+ 7.1	60.5 60.5		1		9	+ 2.6 + 4.2	29.3 26.9	19.6 19.6	22.8 18.7	42.3 38.7	30.8 30.8	29.3 26.9	30.0 28.8
271	Planes	3	6		2	3	+23.0	86.2 11.1	2	1	3	4	+ 4.0 + 4.0	18.6 20.8	50.7 9.0	56.3 39.0	96.0 —	36.2 10.0	18.6 20.8	27.4 15.4
272	Saws: crosscut	1	8		1	2	+10.5	67.8 11.1	8		1	1	+13.0 +13.0	10.0 10.0	66.0 —	15.0 15.0	81.0 —	32.7 10.0	10.0 10.0	21.3 10.0

273	Saws: hand	1	7		1	3	+13.3	63.3 9.3	8		1	1	+13.0 +13.0	18.2 18.2	186.0 —	15.0 15.0	201.0 —	31.2 8.5	18.2 18.2	24.7 13.3
274	Shovels	6½	3	1		7	+12.3	23.8 22.9	3			7	+ 6.0 + 6.5	10.9 10.9	28.8 18.6	24.7 24.3	53.2 38.0	15.0 13.7	10.9 10.9	12.9 12.3
276	Steel billets	10				11	+ 3.6	103.2				10	— 3.2 — 2.0	40.2	16.7	21.4	38.1	40.1	40.2	40.1
280	Steel rails	5	4			7	+ 5.3	45.7 32.5	5			5	+ 5.2 + 5.5	26.7 26.7	57.6 18.5	18.6 18.6	76.2 39.2	25.3 19.8	26.7 26.7	26.0 23.2
287	Trowels	1	8		1	2	+22.0	55.0 1.7	8		1	1	+14.0 +14.0	5.8 5.8	49.0 —	19.0 19.0	68.0 —	26.8 1.7	5.8 5.8	16.3 3.7
288	Vises	8		1	1	9	+11.1	40.2 35.2		1	1	8	+ 3.9 + 3.9	19.5 19.1	21.0 16.1	28.9 24.9	49.9 39.5	21.1 18.0	19.5 19.1	20.3 18 5
289	Wire: fence	9		1		10	+ 3.6	48.3		1		9	+ .8 + 2.2	23.0	22.3	17.1	39.4	25.5	23.0	24.2
291	Wood screws	9		1	1	9	+ 5.6	80.7				10	+ 5.2 + 6.9	39.2	23.8	16.7	40.2	37.9	39.2	38.5
293	Copper: ingot	10				11	— .2	65.0				10	— 5.1 — 3.7	33.2	18.6	20.2	38.8	33.6	33.2	33.4
294	Copper: sheet	9		1		10	+ 3.1	53.2		1		9	— 3.0 — 1.2	28.6	18.7	20.0	38.7	30.0	28.6	29.3
295	Copper: wire	10				11	+ 1.3	56.3				10	— 5.5 — 4.2	30.7	16.6	22.4	39.0	30.7	30.7	30.7
296	Lead: pig	10				11	— .5	66.2				10	— 1.9 — .4	30.0	22.1	15.8	37.9	32.8	30.0	31.4
297	Lead: pipe	8	1	1		9	— .8	66.3	1	1		8	— 2.6 — 1.0	28.6	24.1	15.6	39.7	35.2	28.6	31.9
298	Quicksilver	9		1		10	+ 3.0	59.0 59.0		1		9	+ 2.3 + 2.4	24.7 24.9	23.0 23.0	18.4 13.4	41.4 33.6	26.5 26.5	24.7 24.9	25.6 25.7
299	Silver	8		1	1	9	+ 1.4	41.5 21.9		1	1	8	— .2 — .2	23.6 23.6	25.6 21.7	18.5 18.5	44.1 40.9	23.5 17.7	23.6 23.6	23.5 20.6
300	Tin: pig	10				11	+ .1	73.8				10	0 + .4	31.8	23.3	15.6	38.9	34.6	31.8	33.2
301	Zinc: sheet	8		1		10	+ 1.7	70.6 64.5		1	1	8	— 5.5 — .9	26.3 26.3	23.0 17.6	20.7 20.7	43.7 36.1	31.6 28.5	26.3 26.3	28.9 27.4
302	Zinc: slab	9		1		10	— 2.4	88.3		1		9	— 7.7 — 3.7	35.3	20.1	19.1	39.2	39.8	35.3	37.5

TABLE XII (Cont.)

(1) Ref. No.	(2) Commodity	(3) No. of cycles observed	(4) Behavior during revival	(5)	(6)	(7)	(8)	(9)	(10) Behavior during recession	(11)	(12)	(13)	(14)	(15)	(16) Average duration of	(17)	(18)	(19) Av. percentage of	(20)	(21) Index of cyclical variability
			Constant	Sagging	Rising	Turns observed	Av. time as a deviation in months from the reference date	Av. percentage of rise based on preceding low value	Constant	Sagging	Rising	Turns observed	Av. time as a deviation in months from the reference date	Av. percentage of fall based on preceding high value	Rise in mos.	Fall in mos.	Cycle in mos.	Rise based on ensuing high value	Fall based on preceding high value	
306	Hemlock: N. Y.	6	1	1	1	8	+ 6.4	47.9 21.9	3		1	6	+ 4.2 + 4.2	15.2 15.2	38.3 24.7	17.5 17.5	55.8 41.7	24.8 15.5	15.2 15.2	20.0 15.3
308	Maple: N. Y	6	2		1	8	+11.2	55.1 44.9	3		1	6	+ 7.0 + 6.8	13.4 13.4	35.0 20.4	14.0 14.0	49.0 36.6	29.7 25.3	13.4 13.4	21.5 19.3
310	Oak: white, plain N. Y.	6	2		2	7	+ 7.3	77.1 13.5	2		2	6	+ 1.3 + 1.3	20.7 23.6	38.7 20.3	27.3 21.0	66.0 35.5	30 1 11.6	20.7 23.6	25.4 17.6
312	Oak: white, quartered, N. Y.	8½	2			9	+11.0	47.1 51.2	1			9	+11.9 +13.0	13.2 13.2	28.9 23.9	15.4 15.4	44.5 38.9	24.5 25.8	13.2 13.2	18.8 19.5
313	Pine: white boards	7½		2		9	+12.1	32.7 27.2	1	1		8	+ 8.5 + 9.1	8.2 6.2	28.4 23.1	20.0 12.7	51.3 42.4	22.7 20.0	8.2 6.2	15.4 13.1
317	Pine: yellow siding	5	1	1	1	8	+ 3.6	120.4 35.7	3	1	1	5	— 1.4 — 1.4	28.0 28.0	45.0 23.3	19.4 19.4	64.4 42.3	40.9 24.6	28.0 28.0	34.4 26.3
319	Poplar: N. Y.	9	1			10	+ 9.8	37.8 37.8	1			9	+ 5.0 + 5.2	12.0 12.0	20.1 20.1	22.8 18.0	42.9 39.0	23.1 23.1	12.0 12.0	17.5 17.5
321	Spruce	9			1	10	+ 2.2	36.8 28.8			1	9	+ 7.8 + 7.8	17.3 17.3	25.3 22.1	18.3 18.3	43.7 39.9	25.0 21.9	17.3 17.3	21.1 19.6
323	Shingles: cypress	5	2	2	1	6	+ 3.7	55.5 30.7	2	2	1	5	— 2.6 — 2.6	23.2 23.2	39.2 29.7	20.2 20.2	59.4 50.0	28.8 21.7	23.2 23.2	26.0 22.4
324	Shingles: red cedar	8		1	1	9	+ 6.6	67.4 72.2		1	1	8	— 1.7 + .3	30.4 33.3	21.1 15.6	26.2 20.1	47.4 37.0	34.3 35.6	30.4 33.3	32.3 34.4
327	Brick	9			1	10	0	91.7 54.7			1	9	— 2.4 — 2.4	35.3 35.3	25.2 20.0	18.3 18.3	43.6 38.5	39.3 34.3	35.3 35.3	37.3 34.8
335	Doors	6½		2	2	7	+ 6.3	70.9 25.0		1	2	7	— .7 — .7	25.6 22.5	28.3 17.8	28.3 23.2	57.8 49.3	31.2 17.7	25.6 22.5	28.4 20.1

338	Lime[6]	4	1	2	1	5	— .6	109.2 37.6	1	1	1	5	+ .8 + .2	27.7 27.7	61.5 9.0	17.7 17.7	79.2 32.3	38.4 25.8	27.7 27.7	33.0 26.7
344	Glass: window, A	9			1	10	+ 2.8	78.8 55.5			1	9	+ 1.9 + 1.4	34.1 34.1	28.2 21.6	16.1 16.1	44.3 39.2	36.2 31.6	34.1 34.1	35.1 32.8
345	Glass: window, B	10				11	+ 2.4	67.6				10	+ 1.5 + 1.0	29.5	24.0	15.9	39.9	33.6	29.5	31.5
348	Linseed oil	10				11	— 1.5	96.5				10	+ 1.0 + 1.2	36.6	25.9	12.6	38.5	42.0	36.6	39.3
349	Putty	5½	4	1		6	+10.0	59.8 59.8	3	1		6	+ 4.8 + 6.2	24.1 25.9	26.3 19.2	34.8 16.7	65.6 39.0	31.1 31.1	24.1 25.9	27.6 28.5
350	Rosin	9			1	10	+ 2.8	124.5 109.7			1	9	+ .8 + .6	36.8 36.8	26.0 20.6	16.2 16.2	42.2 37.0	43.7 40.3	36.8 36.8	40.2 38.5
352	Tar	8		1		9[3]	+ 3.8	88.3	1	1		8	+ 2.1 + 3.6	37.7	25.0	17.4	42.2	44.4	37.7	41.0
353	Turpentine: spirits of	9			1	10	— .7	139.8 88.9			1	9	+ 1.0 + 1.0	42.0 42.0	28.9 25.7	14.0 14.0	43.0 40.1	46.6 41.8	42.0 42.0	44.3 41.9
354	Lead: carbonate of	10				11	+ 2.6	25.3				10	+ 4.2 + 4.3	12.7	24.1	14.9	39.0	17.2	12.7	14.9
355	Zinc: oxide of	8				11	+ 8.3	26.1 13.5	2			8	+ 1.5 + 3.0	12.8 12.8	28.2 13.3	22.1 22.1	50.4 35.2	17.4 11.4	12.8 12.8	15.1 12.1
357	Acid: muriatic	4½	3	2	1	5	+ .2	87.0 72.1	2	2	1	5	— 2.0 — 1.2	37.1 39.6	26.2 16.7	53.5 18.7	82.2 35.7	42.0 37.6	37.1 39.6	39.5 38.6
360	Acid: sulphuric	5½	4		1	6	— 1.2	56.4 47.7	3		1	6	— 5.7 — 5.8	30.2 30.2	27.0 20.0	46.4 21.7	77.0 47.0	30.7 26.8	30.2 30.2	30.4 28.5
362	Alcohol: wood	9	1			10	— 1.5	85.3 85.3	1			9	+ 1.4 + 2.5	39.4 39.4	30.8 27.4	13.4 13.4	44.2 38.6	37.1 37.1	39.4 39.4	38.2 38.2
363	Alum	5	4			7	0	61.4 14.9	5			5	+ 8.8 +10.5	19.1 19.1	62.8 18.7	10.4 10.4	73.2 31.7	22.7 10.3	19.1 19.1	20.9 14.7
377	Soda: bicarbonate of	5½	4	1		6	+14.3	69.3 69.3	2	1		7	+ 4.9 + 5.3	33.3 28.0	13.2 13.2	57.8 22.0	72.4 40.7	28.2 28.2	33.3 28.0	30.7 28.1
381	Sulphur	4	1	4		6	+ 1.8	74.1 55.2	3	3		4	—10.0 —10.3	35.5 24.4	47.7 24.0	39.7 23.3	87.5 47.3	35.4 28.3	35.5 24.4	35.4 26.3
382	Tallow	10				11	— 1.6	74.4				10	— 1.7 — 1.8	35.4	23.5	14.8	38.3	38.2	35.4	36.8
393	Alcohol: grain	8			2	9	— 3.9	26.6 28.7			2	8	— 7.2 — 6.8	9.4 9.4	25.9 20.6	18.6 18.6	44.5 39.1	16.2 17.0	9.4 9.4	12.8 13.2

TABLE XII (Cont.)

(1) Ref No.	(2) Commodity	(3) No. of cycles observed	(4) Behavior during revival	(5)	(6)	(7)	(8)	(9)	(10) Behavior during recession	(11)	(12)	(13)	(14)	(15)	(16) Average duration of	(17)	(18)	(19) Av. percentage of	(20)	(21) Index of cyclical variability
			Constant	Sagging	Rising	Turns observed	Av. time as a deviation in months from the reference date	Av. percentage of rise based on preceding low value	Constant	Sagging	Rising	Turns observed	Av. time as a deviation in months from the reference date	Av. percentage of fall based on preceding high value	Rise in mos.	Fall in mos.	Cycle in mos.	Rise based on ensuing high value	Fall based on preceding high value	
396	Glycerine	8		2		9	+ 4.6	81.6 81.6		2		8	+ 5.0 + 7.0	35.3 36.3	24.7 24.7	18.6 12.0	43.4 34.9	39.4 39.4	35.3 36.3	37.3 37.8
397	Opium	9			1	10	— .3	111.8			1	9	— .6 + .2	35.6	24.4	14.8	39.2	43.1	35.6	39.3
400	Quinine	7½	3			8	+11.0	85.5 85.5	2			8	+ 3.4 + 3.1	32.5 32.5	16.5 16.5	28 3 22.7	45.7 42.5	37.1 37.1	32.5 32.5	34.8 34.8
405	Bedroom chairs	3½	2	2	1	6	+11.7	104.6 35.5	3	2	1	4	+ 8.7 + 8.7	20.1 20.1	56.7 23.5	27.3 19.5	96.3 43.0	38.2 23.7	20.1 20.1	29.1 21.9
406	Bedroom sets	4½		3	1	7	+11.3	71.1 74.1	2	2	1	5	+ 4.6 + 5.0	15.8 15.8	48.0 21.3	16.7 16.7	74.2 40.5	38.6 37.7	15.8 15.8	27.2 26.7
412	Kitchen chairs	6½	1	1		9	+12.6	51.9 38.0	1		1	8	+10.6 +11.7	16.0 14.5	31.9 21.2	26.0 19.8	62.0 47.5	27.8 22.8	16.0 14.5	21.9 18.6
414	Kitchen tables	2	3	1	1	6	+16.7	284.2 24.3	5		1	4	+ 5.5 + 5.5	21.2 34.5	134.0 10.0	43.5 21.0	279.0 ——	52.0 19.6	21.2 34.5	36 6 27.0
417	Carpets: Axminster	7	1	1	1	8	+ 5.9	37.9 40.9	1	1	1	7	+ 6.7 + 7.0	13.7 12.2	32.3 26.7	22.3 13.2	54.6 42.8	23.1 24.2	13.7 12.2	18.4 18.2
418	Carpets: Brussels	6	1		1	9	+ 4.6	42.6 53.0	3		1	6	+ 4.0 + 3.8	11.7 11.7	48.2 26.2	19.5 10.8	67.7 38.0	23.6 26.9	11.7 11.7	17.6 19.3
419	Carpets: Wilton	6	2			9	+ 2.7	39.5 47.6	2		2	6	+ 2.5 + 2.0	12.3 12.3	47.5 25.2	19.8 10.6	67.3 39.3	22.9 25.3	12.3 12.3	17.6 18.8
422	Pails	4	2	1	3	5	+ 8.0	89.6 23.3	1	1	3	5	+ 7.6 + 7.6	26.1 29.2	59.7 10.5	24.2 16.0	84.0 24.5	38.5 18.8	26.1 29.2	32.3 24.0
423	Sheeting: 10-4 Pepperell	10				11	+ 5.1	54.1				10	+ 3.7 + 3.8	25.5	23.0	15.8	38.8	30.0	25.5	27.7

424	Sheeting: 10-4 Wamsutta	8	1			10	+13.6	42.4 45.6	2			8	+ 7.4 + 8.0	16.4 16.4	25.1 20.6	20.0 20.0	45.1 38.6	22.4 23.4	16.4 16.4	19.4 19.9
425	Nappies	2	5	2	2	2	+36.5	133.6 40.0	4	1	2	3	+ 3.7 + 3.7	19.0 19.0	84.0 —	66.0 60.0	156.0 —	49.0 28.6	19.0 19.0	34.0 23.8
426	Pitchers	5½	4		1	6	+21.2	55.1 26.2	2		1	7	+ 9.3 + 9.3	20.3 17.3	26.8 12.7	36.0 31.2	60.4 40.7	28.9 20.3	20.3 17.3	24.6 18.8
427	Tumblers	5	3	1		7	+ 8.9	61.1 65.8	1	1		8	+ 4.5 + 4.3	30.9 18.1	24.6 21.7	56.6 12.5	81.2 30.5	27.3 26.7	30.9 18.1	29.1 22.4
428	Plates	2½	4	2	1	4	+14.7	80.0 17.4	5	1	1	3	+11.3 +11.3	15.6 15.6	72.7 24.0	53.0 19.0	150.0 —	31.9 14.2	15.6 15.6	23.7 14.9
429	Teacups and saucers	2½	4	2	1	4	+14.7	82.6 14.4	5	1	1	3	+11.3 +11.3	15.6 15.6	72.7 24.0	53.0 19.0	150.0 —	31.1 12.3	15.6 15.6	23.3 13.9
430	Tickings: Amoskeag,	9½		1		10	+ 3.8	63.5				10	+ 4.7 + 5.3	27.4	23.9	14.8	38.1	30.5	27.4	28.9
431	Tubs	3½	3	1	2	5	+19.4	118.1 38.3	4		2	4	+ 5.5 + 5.5	23.3 23.3	82.3 13.0	35.7 20.3	102.7 39.0	42.0 27.7	23.3 23.3	32.6 25.5
433	Cottonseed meal	9			1	10	+ 1.4	52.8 35.4			1	9	— 4.9 — 4.9	26.0 26.0	20.1 15.1	22.2 22.2	42.3 38.0	29.7 25.2	26.0 26.0	27.8 25.6
436	Leather: calf	10				11	— .1	49.2				10	— 3.5 — 1.6	19.1	20.1	19.6	39.7	26.1	19.1	22.6
438	Leather: harness oak	9				11	+ .8	35.7 28.7	1			9	+ .7 + .6	18.7 18.7	27.0 19.1	15.7 15.7	42.7 36.2	24.0 21.0	18.7 18.7	21.3 19.8
440	Leather: sole oak	10				11	— 1.2	30.8				10	— 1.0 + .9	15.6	24.1	14.8	38.9	20.6	15.6	18.1
441	Leather: sole oak, scoured backs	9			1	10	— .8	33.0 22.0			1	9	— 2.3 — 1.5	19.8 19.8	26.2 19.2	15.7 15.7	41.9 35.5	21.4 17.3	19.8 19.8	20.6 18.5
443	Paper: newsprint	7½	1	2		8	+12.2	4.4		2		8	+ 6.9 +10.0	19.8	21.9	17.3	38.6	26.8	19.8	23.3
444	Paper: wrapping, Manila	7	1		2	8	+ 5.2	42.6 43.5	1		2	7	+12.7 +14.0	18.7 18.7	36.0 29.2	14.0 10.0	50.0 38.6	22.2 21.5	18.7 18.7	20.4 20.1
448	Jute	10				11	+ 1.6	91.7				10	+ 2.6 + 2.8	39.2	23.4	15.2	38.6	42.5	39.2	40.8
450	Rope	10				11	+ 1.4	60.6				10	+ .5 + .3	28.9	22.0	16.8	38.8	31.0	28.9	29.9
451	Rubber	9			1	10	— .9	67.8 64.4			1	9	— 5.7 — 6.4	41.0 41.0	23.7 22.4	20.0 20.0	43.7 40.7	31.5 29.3	41.0 41.0	36.2 35.1

TABLE XII (Conc.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
Ref. No.	Commodity	No. of cycles observed	Behavior during revival						Behavior during recession						Average duration of			Av. percentage of		Index of cyclical variability
			Constant	Sagging	Rising	Turns observed	Av. time as a deviation in months from the reference date	Av. percentage of rise based on preceding low value	Constant	Sagging	Rising	Turns observed	Av. time as a deviation in months from the reference date	Av. percentage of fall based on preceding high value	Rise in mos.	Fall in mos.	Cycle in mos.	Rise based on ensuing high value	Fall based on preceding high value	
455	Starch: laundry	7	1		2	8	+ 1.1	47.4 42.4	1		2	7	— 1.3 + .7	25.9 25.9	30.9 19.4	22.3 19.8	53.1 32.2	29.5 26.8	25.9 25.9	27.7 26.3
456	Tobacco: plug	3½	6		1	4	+ 5.7	37.5 16.7	4		1	5	+ 4.8 + 4.8	9.5 8.2	52.5 50.0	42.3 13.5	87.7 64.0	22.8 13.7	9.5 8.2	16.1 10.9
457	Tobacco: smoking	1½	6		2	3	+10.7	37.2 —	6		2	2	+ 4.0 + 4.0	9.7 9.7	149.0 —	9.0 9.0	150.0 —	25.9 —	9.7 9.7	17.8 —

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[2] No sales during one phase of revival.

[3] No quotation during one phase of revival.

[4] No quotation during one phase of recession.

[5] Strike during one phase of recession.

[6] The measures for lime (commodity No. 338) relate to the eight cycles occurring between 1890 and 1919. A change of grade in 1920 made it impossible to carry the analysis through the entire period.

TABLE XIII

MEASURES DESCRIBING THE BEHAVIOR OF WHOLESALE COMMODITY PRICES DURING PERIODS OF REVIVAL AND RECESSION IN AMERICAN BUSINESS, 1890-1925

Ranking of Commodities, by Groups, according to the Average Duration of Cycle.[1]

(1) Ref. No.	(2) Commodity	(3) Average duration of cycle (in months)
	Farm products	
13	Cattle: choice to prime	37.0
1	*Barley	37.3
49	*Onions	37.4
19	Sheep: wethers	38.0
17	Sheep: ewes	38.2
42	Hides	38.3
16	Hogs: light	38.4
22	*Beans	38.4
47	Milk	38.4
25	Cotton	38.7
15	Hogs: heavy	38.8
14	Cattle: good to choice	38.9
51	*Potatoes	39.1
2	*Corn	39.7
4	*Oats	41.2
59	Wool: medium	43.5 (37.7)
53	Rice	43.6 (39.6)
5	*Rye	44.7 (37.9)
37	*Hay	46.9 (40.9)
44	*Hops	47.5 (44.3)
31	*Eggs	48.0 (36.2)
56	Wool: fine clothing	48.1 (37.7)
34	*Flaxseed	49.4 (39.3)
6	*Wheat	56.8 (49.7)
	Foods	
109	Coffee	37.6
74	Pork: cured, salt mess	38.1
158	Cottonseed oil	38.5
152	*Tea	38.8
64	Beef: fresh	38.9
130	Prunes	39.1
161	*Vinegar	39.2
99	*Cheese	39.3
71	Mutton	39.5
69	Hams	39.7
89	*Butter: creamery extra, N. Y.	39.8
95	*Butter: creamery extra, St. Louis	39.8

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[1] The main entries in this table are averages based upon all the cycles in individual commodity prices In computing the averages given in parentheses exceptionally long cycles in the prices of individual commodities (i. e. those which extended over two or more cycles in general business) have been excluded. For a more detailed explanation see text, pp. 89-90.

*The commodities marked with an asterisk have price movements which are irregular, in the sense that they do not conform in any systematic fashion to the cyclical movements of general prices. For a more detailed explanation see text, pp. 81, 102.

TABLE XIII (Cont.)

(1) Ref. No.	(2) Commodity	(3) Average duration of cycle (in months)
	Foods (cont.)	
90	*Butter: creamery firsts, N. Y.	39.9
129	*Currants	39.9
139	Meal: corn, fine white	40.3
140	Meal: corn, yellow table	40.3
68	Beef: salt	41.4 (36.1)
115	Mackerel	41.9
128	*Apples	41.9 (39.7)
119	*Flour: wheat, winter straights	43.1 (41.6)
120	*Flour: wheat, standard patents	43.1 (40.4)
113	Cod	43.5
76	Pork: cured, short clear sides	43.9 (41.1)
75	Pork: cured, rough sides	44.2 (41.4)
149	*Sugar: raw	44.3 (42.1)
150	*Sugar: granulated	44.9 (42.7)
146	*Salt	45.9 (38.4)
145	Pepper	47.7 (42.0)
138	Lard	49.9 (40.0)
117	*Flour: rye	50.0
116	Salmon	51.3 (42.5)
114	Herring	53.6 (48.2)
141	Molasses	54.3 (45.8)
131	Raisins	55.0 (42.8)
112	Crackers: soda	56.2 (34.0)
106	Bread: N. Y.	58.7 (30.0)
111	Crackers: oyster	65.8 (45.3)
148	Starch: corn	86.2 (51.0)
104	Bread: Cincinnati	94.5 (——)
	Cloths and clothing	
192	Muslin: Rough Rider	36.8
191	Muslin: Lonsdale	38.0
183	Flannel: colored	38.1
220	Worsted yarns: 2-32's	38.1
190	Muslin: Fruit of the Loom	38.2
181	Drillings: Pepperell	38.3
184	Flannel: unbleached	38.5
186	Ginghams: Lancaster	38.8
182	Drillings: Mass. D	38.9
196	Sheetings: 4-4 Indian Head	39.0
228	Silk: raw, Japanese extra-extra	39.0
226	Silk: raw, Japanese Kansai No. 1	39.1
180	Denims	39.2
193	Muslin: Wamsutta	39.6
195	Print cloths	39.9
202	Cotton yarns: carded, cones 10/1	39.9
197	Sheetings: 4-4 Pepperell R	40.0
203	Cotton yarns: carded, cones 22/1	40.8
185	Ginghams: Amoskeag	41.0
221	Worsted yarns: 2-40's	43.3 (41.5)
179	Calico	43.4 (39.6)

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*See footnote on page 543.

TABLE XIII (Cont.)

(1) Ref. No.	(2) Commodity	(3) Average duration of cycle (in months)
	Cloths and clothing (cont.)	
198	Sheetings: 4-4, Ware Shoals	44.1 (40.1)
206	Flannels: white	44.5 (37.7)
217	Storm serge	47.7 (43.1)
173	Men's shoes: chocolate elk	51.0 (36.7)
210	Suiting: Middlesex	53.5 (35.4)
216	French serge	54.0 (46.2)
219	Sicilian cloth	55.6 (41.7)
218	Poplar cloth	55.8 (53.3)
215	Broadcloth	60.0 (40.3)
177	Women's shoes	67.4 (39.3)
166	Men's shoes: black calf	72.0 (32.0)
199	Cotton thread	96.0 (45.0)
174	Men's shoes: vici kid	108.5 (——)
213	Underwear: shirts and drawers	124.7 (26.0)
223	Linen shoe thread	124.7 (——)
214	Underwear: union suits	189.0 (——)
	Fuel and lighting	
239	Coke	37.9
236	Bituminous coal: Kanawha	39.9
233	Anthracite coal: chestnut	40.7
235	Anthracite coal: stove	42.5
234	Anthracite coal: egg	44.0
247	Petroleum: crude	46.6 (37.7)
238	Bituminous coal: Pocahontas	48.0 (39.1)
248	Petroleum: refined, for export	49.3 (38.2)
249	Petroleum: refined, 150° fire test	49.3 (42.6)
237	Bituminous coal: New River	51.6 (37.7)
232	Anthracite coal: broken	84.2 (34.6)
244	Matches	240.0 (——)
	Metals and metal products	
259	Pig iron: basic	37.8
261	Pig iron: foundry No. 2, Northern	37.8
296	Lead: pig	37.9
260	Pig iron: Bessemer	38.0
276	Steel billets	38.1
263	Pig iron: foundry No. 2, Southern	38.5
294	Copper: sheet	38.7
293	Copper: ingot	38.8
300	Tin: pig	38.9
295	Copper: wire	39.0
267	Bar iron: from mill, Pittsburgh	39.1
266	Bar iron: from store, Phila.	39.2
302	Zinc: slab	39.2
289	Wire: fence	39.4
297	Lead: pipe	39.7
291	Wood screws	40.2
298	Quicksilver	41.4 (33.6)
269	Nails: wire	42.3 (38.7)
301	Zinc: sheet	43.7 (36.1)

TABLE XIII (Cont.)

(1) Ref. No.	(2) Commodity	(3) Average duration of cycle (in months)
	Metals and metal products (cont.)	
299	Silver	44.1 (40.9)
253	Door knobs	46.7 (39.0)
258	Locks	47.0 (39.3)
288	Vises	49.9 (39.5)
274	Shovels	53.2 (38.0)
251	Butts	55.1 (37.5)
250	Augers	62.7 (44.5)
252	Chisels	64.8 (36.0)
287	Trowels	68.0 (——)
280	Steel rails	76.2 (39.2)
272	Saws: crosscut	81.0 (——)
255	Hammers	87.5 (30.0)
271	Planes	96.0 (——)
254	Files	100.7 (42.5)
273	Saws: hand	201.0 (——)
	Building materials	
348	Linseed oil	38.5
354	Lead: carbonate of	39.0
345	Glass: window, B	39.9
350	Rosin	42.2 (37.0)
352	Tar	42.4
319	Poplar: N. Y.	42.9 (39.0)
353	Turpentine: spirits of	43.0 (40.1)
327	Brick	43.6 (38.5)
321	Spruce	43.7 (39.9)
344	Glass: window, A	44.3 (39.2)
312	Oak: white, quartered, N. Y.	44.5 (38.9)
324	Shingles: red cedar	47.4 (37.0)
308	Maple: N, Y.	49.0 (36.6)
355	Zinc: oxide of	50.4 (35.2)
313	Pine: white boards	51.3 (42.4)
306	Hemlock: N. Y.	55.8 (41.7)
335	Doors	57.8 (49.3)
323	Shingles: cypress	59.4 (50.0)
317	Pine: yellow siding	64.4 (42.3)
449	Putty	65.6 (39.0)
310	Oak: white, plain, N. Y.	66.0 (35.5)
338	Lime	79.2 (32.3)
	Chemicals and drugs	
382	Tallow	38.3
397	Opium	39.2
396	Glycerine	43.4 (34.9)
362	Alcohol: wood	44.2 (38.6)
393	Alcohol: grain	44.5 (39.1)
400	Quinine	45.7 (42.5)
377	Soda: bicarbonate of	72.4 (40.7)
363	Alum	73.2 (31.7)
360	Acid: sulphuric	77.0 (47.0)
357	Acid: muriatic	82.2 (35.7)
381	Sulphur	87.5 (47.3)

TABLE XIII (Conc.)

(1) Ref. No.	(2) Commodity	(3) Average duration of cycle (in months)
	House-furnishings	
430	Tickings: Amoskeag	38.1
423	Sheeting: 10-4 Pepperell	38.8
424	Sheeting: 10-4 Wamsutta	45.1 (38.6)
417	Carpets: Axminster	54.6 (42.8)
426	Pitchers	60.4 (40.7)
412	Kitchen chairs	62.0 (47.5)
419	Carpets: Wilton	67.3 (39.3)
418	Carpets: Brussels	67.7 (38.0)
406	Bedroom sets	74.2 (40.5)
427	Tumblers	81.2 (30.5)
422	Pails	84.0 (24.5)
405	Bedroom chairs	96.3 (43.0)
431	Tubs	102.7 (39.0)
428	Plates	150.0 (——)
429	Teacups and saucers	150.0 (——)
425	Nappies	156.0 (——)
414	Kitchen tables	279.0 (——)
	Miscellaneous	
443	Paper: newsprint	38.6
448	Jute	38.6
450	Rope	38.8
440	Leather: sole oak	38.9
436	Leather: calf	39.7
441	Leather: sole oak, scoured backs	41.9 (35.5)
433	Cottonseed meal	42.3 (38.0)
438	Leather: harness oak	42.7 (36.2)
451	Rubber	43.7 (40.7)
444	Paper: wrapping, Manila	50.0 (38.6)
455	Starch: laundry	53.1 (32.2)
456	Tobacco: plug	87.7 (64.0)
457	Tobacco: smoking	150.0 (——)

TABLE XIV

MEASURES DESCRIBING THE BEHAVIOR OF WHOLESALE COMMODITY PRICES DURING PERIODS OF REVIVAL AND RECESSION IN AMERICAN BUSINESS, 1890-1925

Ranking of Commodities, by Groups, according to the Amplitude of Cyclical Price Movements[1]

(1) Ref. No.	(2) Commodity	(3) Index of cyclical variability
	Farm products	
14	Cattle: good to choice	27.2
13	Cattle: choice to prime	29.3
53	Rice	29.3
59	Wool: medium	29.8 (30.3)
56	Wool: fine clothing	32.0 (32.6)
37	*Hay	38.2 (37.7)
15	Hogs: heavy	39.0
16	Hogs: light	39.1
5	*Rye	40.0 (41.6)
22	*Beans	40.2
1	*Barley	40.9
2	*Corn	41.5
47	Milk	41.7
42	Hides	42.0
6	*Wheat	44.0 (41.5)
4	*Oats	44.4
25	Cotton	44.7
34	*Flaxseed	45.6 (42.1)
19	Sheep: wethers	48.1
17	Sheep: ewes	50.7
31	*Eggs	60.6 (58.9)
44	*Hops	65.3 (63.1)
51	*Potatoes	71.4
49	*Onions	77.4
	Foods	
152	*Tea	18.2
116	Salmon	20.2 (18.4)
112	Crackers: soda	20.6 (20.5)
106	Bread: N. Y.	21.1 (18.6)
148	Starch: corn	22.9 (19.2)
111	Crackers: oyster	23.5 (22.3)
113	Cod	23.5 (21.9)
64	Beef: fresh	27.7
146	*Salt	28.7 (26.3)
161	*Vinegar	30.2 (30.4)
114	Herring	30.3 (26.5)
141	Molasses	31.3 (28.3)
69	Hams	32.2
68	Beef: salt	33.6 (32.6)
145	Pepper	33.6 (31.1)

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[1] The main entries in this table are averages based upon all the cycles in individual commodity prices. In computing the averages given in parentheses account has been taken only of percentages of rise and fall relating to successive phases of specific cycles. For more detailed explanation see text, pp. 89-90.

*The commodities marked with an asterisk have price movements which are irregular, in the sense that they do not conform in any systematic fashion to the cyclical movements of general prices. For a more detailed explanation see text, pp. 81, 102.

TABLE XIV (Cont.)

(1) Ref. No.	(2) Commodity	(3) Index of cyclical variability
	Foods (cont.)	
120	*Flour: wheat, standard patents	34.2 (32.3)
150	*Sugar: granulated	35.3 (34.7)
99	*Cheese	36.3
74	Pork: cured, salt mess	36.5
104	Bread: Cincinnati	37.4 (26.4)
140	Meal: corn, yellow table	37.6
109	Coffee	37.7
139	Meal: corn, fine white	37.7
90	*Butter: creamery firsts, N. Y.	37.8
119	*Flour: wheat, winter straights	38.7 (36.8)
89	*Butter: creamery extra, N. Y.	39.7
129	*Currants	39.8
95	*Butter: creamery extra, St. Louis	40.4
117	*Flour: rye	40.5 (37.9)
76	Pork: cured, short clear sides	41.4 (39.8)
115	Mackerel	41.7
149	*Sugar: raw	42.0 (41.5)
158	Cottonseed oil	42.0
75	Pork: cured, rough sides	42.2 (40.6)
131	Raisins	42.7 (38.0)
130	Prunes	42.8
138	Lard	42.9 (39.1)
71	Mutton	47.7
128	*Apples	51.7 (50.1)
	Cloths and clothing	
206	Flannels: white	15.3
173	Men's shoes: chocolate elk	15.7 (13.1)
166	Men's shoes: black calf	17.6 (8.3)
213	Underwear: shirts and drawers	18.1 (12.1)
193	Muslin: Wamsutta	19.6
177	Women's shoes	19.9 (13.5)
210	Suiting: Middlesex	20.7 (18.0)
219	Sicilian cloth	21.0
223	Linen shoe thread	21.3 (6.1)
215	Broadcloth	21.5 (14.1)
218	Poplar cloth	21.6
217	Storm serge	22.7 (22.3)
216	French serge	23.0 (20.8)
186	Ginghams: Lancaster	23.4
185	Ginghams: Amoskeag	23.8
192	Muslin: Rough Rider	24.1
221	Worsted yarns: 2-40's	24.8 (23.7)
220	Worsted yarns: 2-32's	25.6
180	Denims	26.0
179	Calico	26.2
181	Drillings: Pepperell	26.4
196	Sheetings: 4-4 Indian Head	26.4
191	Muslin: Lonsdale	27.6
190	Muslin: Fruit of the Loom	27.7
174	Men's shoes: vici kid	27.8 (12.2)

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*See footnote on page 548.

TABLE XIV (Cont.)

(1) Ref. No.	(2) Commodity	(3) Index of cyclical variability
	Cloths and clothing (cont.)	
199	Cotton thread	28.4 (28.7)
197	Sheetings: 4-4 Pepperell R	29.0
182	Drillings: Mass. D	29.5
184	Flannel: unbleached	29.6
203	Cotton yarns: carded, cones 22/1	33.6
183	Flannel: colored	34.6
198	Sheetings: 4-4 Ware Shoals	34.9 (34.7)
228	Silk: raw, Japanese, extra-extra	35.3
202	Cotton yarns: carded, cones 10/1	35.8
226	Silk: raw, Japanese, Kansai No. 1	36.2
214	Underwear: union suits	40.1 (26.6)
195	Print cloths	42.7
	Fuel and lighting	
232	Anthracite coal: broken	12.9 (11.0)
244	Matches	21.4
249	Petroleum: refined, 150° fire test	22.8 (19.1)
233	Anthracite coal: chestnut	25.4
234	Anthracite coal: egg	26.4
236	Bituminous coal: Kanawha	29.3
248	Petroleum: refined, for export	29.6 (27.3)
235	Anthracite coal: stove	32.2
238	Bituminous coal: Pocahontas	32.8 (33.8)
237	Bituminous coal: New River	36.5 (30.5)
247	Petroleum: crude	45.0 (44.0)
239	Coke	58.2
	Metals and metal products	
274	Shovels	12.9 (12.3)
287	Trowels	16.3 (3.7)
255	Hammers	18.7 (10.2)
288	Vises	20.3 (18.5)
272	Saws: crosscut	21.3 (10.0)
254	Files	23.3
299	Silver	23.5 (20.6)
289	Wire: fence	24.2
273	Saws: hand	24.7 (13.3)
258	Locks	25.4 (22.4)
298	Quicksilver	25.6 (25.7)
280	Steel rails	26.0 (23.2)
252	Chisels	26.4 (20.3)
253	Door knobs	26.4 (25.0)
251	Butts	26.8 (24.1)
271	Planes	27.4 (15.4)
301	Zinc: sheet	28.9 (27.4)
294	Copper: sheet	29.3
269	Nails: wire	30.0 (28.8)
295	Copper: wire	30.7
250	Augers	31.0 (20.6)
296	Lead: pig	31.4
266	Bar iron: from store, Phila.	31.9
297	Lead: pipe	31.9
300	Tin: pig	33.2
293	Copper: ingot	33.4

TABLE XIV (Cont.)

(1) Ref. No.	(2) Commodity	(3) Index of cyclical variability
	Metals and metal products (cont.)	
267	Bar iron: from mill, Pittsburgh	35.6
259	Pig iron: basic	35.9
302	Zinc: slab	37.5
291	Wood screws	38.5
263	Pig iron: foundry No. 2, Southern	38.8
260	Pig iron: Bessemer	39.3
261	Pig iron: foundry No. 2, Northern	39.4
276	Steel billets	40.1
	Building materials	
354	Lead: carbonate of	14.9
355	Zinc: oxide of	15.1 (12.1)
313	Pine: white boards	15.4 (13.1)
319	Poplar: N. Y.	17.5
312	Oak: white quartered, N. Y.	18.8 (19.5)
306	Hemlock: N. Y.	20.0 (15.3)
321	Spruce	21.1 (19.6)
308	Maple: N. Y.	21.5 (19.3)
310	Oak: white, plain, N. Y.	25.4 (17.6)
323	Shingles: cypress	26.0 (22.4)
349	Putty	27.6 (28.5)
335	Doors	28.4 (20.1)
345	Glass: window, B	31.5
324	Shingles: red cedar	32.3 (34.4)
338	Lime	33.0 (26.7)
317	Pine: yellow siding	34.4 (26.3)
344	Glass: window, A	35.1 (32.8)
327	Brick	37.3 (34.8)
348	Linseed oil	39.3
350	Rosin	40.2 (38.5)
352	Tar	41.0
353	Turpentine: spirits of	44.3 (41.9)
	Chemicals and drugs	
393	Alcohol: grain	12.8 (13.2)
363	Alum	20.9 (14.7)
360	Acid: sulphuric	30.4 (28.5)
377	Soda: bicarbonate of	30.7 (28.1)
400	Quinine	34.8
381	Sulphur	35.4 (26.3)
382	Tallow	36.8
396	Glycerine	37.3 (37.8)
362	Alcohol: wood	38.2
397	Opium	39.3
357	Acid: muriatic	39.5 (38.6)
	House-furnishings	
418	Carpets: Brussels	17.6 (19.3)
419	Carpets: Wilton	17.6 (18.8)
417	Carpets: Axminster	18.4 (18.2)
424	Sheeting: 10-4 Wamsutta	19.4 (19.9)
412	Kitchen chairs	21.9 (18.6)
429	Teacups and saucers	23.3 (13.9)
428	Plates	23.7 (14.9)

TABLE XIV (Conc.)

(1) Ref. No.	(2) Commodity	(3) Index of cyclical variability
	House-furnishings (cont.)	
426	Pitchers	24.6 (18.8)
406	Bedroom sets	27.2 (26.7)
423	Sheeting: 10-4 Pepperell	27.7
430	Tickings: Amoskeag	28.9
405	Bedroom chairs	29.1 (21.9)
427	Tumblers	29.1 (22.4)
422	Pails	32.3 (24.0)
431	Tubs	32.6 (25.5)
425	Nappies	34.0 (23.8)
414	Kitchen tables	36.6 (27.0)
	Miscellaneous	
456	Tobacco: plug	16.1 (10.9)
457	Tobacco: smoking	17.8 (——)
440	Leather: sole oak	18.1
444	Paper: wrapping Manila	20.4 (20.1)
441	Leather: sole oak, scoured backs	20.6 (18.5)
438	Leather: harness oak	21.3 (19.8)
436	Leather: calf	22.6
443	Paper: newsprint	23.3
455	Starch: laundry	27.7 (26.3)
433	Cottonseed meal	27.8 (25.6)
450	Rope	29.9
451	Rubber	36.2 (35.1)
448	Jute	40.8

TABLE XV

MEASURES DESCRIBING THE BEHAVIOR OF WHOLESALE COMMODITY PRICES DURING PERIODS OF REVIVAL AND RECESSION IN AMERICAN BUSINESS, 1890-1925.

Average Sequence of Revival, by Groups, with Measures of Inconsistency.

The figures in column (4) indicate the number of months by which the price turns of specific commodities precede (–) or lag behind (+) the major turns of the general price index.

The measures in column (5) indicate the degree of reliability of the averages in column (4). The smaller the measure in column (5), the more consistent is the commodity in question in respect to the timing of its cyclical price movements.

(1) Ref. No.	(2) Commodity	(3) Number of price revivals	(4) Average deviation from reference date	(5) Measure of inconsistency
	Farm products			
6	*Wheat	7	—13.4	8.1
5	*Rye	9	— 9.6	5.8
42	Hides	11	— 7.0	6.1
19	Sheep: wethers	11	— 6.7	8.4
34	*Flaxseed	9	— 6.3	12.0
49	*Onions	11	— 5.9	11.6
17	Sheep: ewes	11	— 5.7	7.5
1	*Barley	11	— 5.5	9.9
13	Cattle: choice to prime	11	— 5.5	7.2
53	Rice	10	— 4.1	9.8
4	*Oats	10	— 3.3	13.0
15	Hogs: heavy	11	— 2.5	7.4
56	Wool: fine clothing	9	— 2.1	4.0
22	*Beans	11	— 1.9	5.9
14	Cattle: good to choice	11	— 1.8	8.8
16	Hogs: light	11	— 1.2	5.7
2	*Corn	10	— 1.0	11.1
31	*Eggs	9	— 1.0	4.1
59	Wool: medium	9	— .7	4.5
44	*Hops	9	+ .9	10.7
51	*Potatoes	11	+ 2.9	13.0
47	Milk	11	+ 3.1	7.3
25	Cotton	10	+ 3.2	7.2
37	*Hay	9	+ 8.7	9.6
	Foods			
140	Meal: corn, yellow table	10	— 6.3	9.2
139	Meal: corn, fine white	10	— 6.0	9.2
120	*Flour: wheat, standard patents	9	— 5.7	12.3
76	Pork: cured, short clear sides	10	— 5.2	9.7
75	Pork: cured, rough sides	10	— 4.8	9.7
99	*Cheese	11	— 4.5	6.5
129	*Currants	10	— 3.6	11.6

*The commodities marked with an asterisk have price movements which are irregular, in the sense that they do not conform in any systematic fashion to the cyclical movements of general prices. For a more detailed explanation see text, pp. 81, 102.

TABLE XV (Cont.)

(1) Ref. No.	(2) Commodity	(3) Number of price revivals	(4) Average deviation from reference date	(5) Measure of inconsistency
	Foods (cont.)			
89	*Butter: creamery extra, N. Y.	11	— 2.7	5.0
95	*Butter: creamery extra, St. Louis	11	— 2.7	5.0
138	Lard	9	— 2.6	6.0
90	*Butter: creamery firsts, N. Y.	11	— 2.5	5.3
74	Pork: cured, salt mess	11	— 1.7	9.1
145	Pepper	9	— 1.6	9.4
119	*Flour: wheat, winter straights	9	— 1.4	12.7
158	Cottonseed oil	11	— .5	5.4
71	Mutton	11	— .1	8.0
64	Beef: fresh	11	+ .3	7.7
130	Prunes	11	+ .9	10.8
69	Hams	11	+ 1.1	8.3
109	Coffee	11	+ 1.8	12.5
68	Beef: salt	10	+ 1.9	7.8
114	Herring	9	+ 2.1	10.6
152	*Tea	11	+ 2.2	10.6
117	*Flour: rye	8	+ 3.0	18.9
111	Crackers: oyster	7	+ 3.1	9.7
128	*Apples	10	+ 3.1	12.0
148	Starch: corn	6	+ 3.2	7.9
150	*Sugar: granulated	10	+ 4.0	10.0
149	*Sugar: raw	10	+ 4.1	12.7
146	*Salt	9	+ 4.2	12.1
112	Crackers: soda	8	+ 4.9	11.6
131	Raisins	8	+ 4.9	14.1
113	Cod	9	+ 5.7	15.0
104	Bread: Cincinnati	4	+ 7.0	11.1
106	Bread: N. Y.	6	+ 7.2	8.3
115	Mackerel	10	+ 7.3	9.8
141	Molasses	8	+ 8.2	14.8
161	*Vinegar	9	+10.0	12.4
116	Salmon	9	+11.9	10.2
	Cloths and clothing			
226	Silk: raw, Japanese, Kansai No. 1	11	— 4.0	6.6
228	Silk: raw, Japanese, extra-extra	11	— 3.4	5.4
221	Worsted yarns: 2-40's	10	— .5	5.8
215	Broadcloth	7	— .3	7.8
217	Storm serge	9	— .1	7.1
216	French serge	8	+ .9	10.5
190	Muslin: Fruit of the Loom	11	+ 1.5	8.0
182	Drillings: Mass. D	10	+ 1.7	13.3
220	Worsted yarns: 2-32's	11	+ 1.9	5.8
195	Print cloths	10	+ 2.0	6.3
174	Men's shoes: vici kid	3	+ 2.3	6.6
206	Flannels: white	9	+ 3.7	6.8
202	Cotton yarns: carded, cones 10/1	10	+ 3.8	9.7
203	Cotton yarns: carded, cones 22/1	11	+ 3.9	9.1
173	Men's shoes: chocolate elk	8	+ 4.1	4.9
186	Ginghams: Lancaster	9	+ 4.3	8.8

*See footnote on page 553.

TABLE XV (Cont.)

(1) Ref. No.	(2) Commodity	(3) Number of price revivals	(4) Average deviation from reference date	(5) Measure of inconsistency
	Cloths and clothing (cont.)			
185	Ginghams: Amoskeag	11	+ 4.8	10.8
191	Muslin: Lonsdale	11	+ 4.9	5.3
180	Denims	10	+ 5.0	7.5
198	Sheetings: 4-4 Ware Shoals	10	+ 5.3	6.4
219	Sicilian cloth	6	+ 5.8	11.1
166	Men's shoes: black calf	5	+ 6.0	6.7
179	Calico	10	+ 6.0	7.8
210	Suiting: Middlesex	8	+ 6.0	7.5
192	Muslin: Rough Rider	11	+ 6.3	10.9
197	Sheetings: 4-4 Pepperell R	11	+ 6.8	7.4
183	Flannel: colored	8	+ 7.6	8.9
213	Underwear: shirts and drawers	6	+ 7.7	12.5
177	Women's shoes	6	+ 7.8	11.4
184	Flannel: unbleached	9	+ 8.1	7.4
181	Drillings: Pepperell	10	+ 8.3	7.7
196	Sheetings: 4-4 Indian Head	10	+ 8.3	8.5
218	Poplar cloth	6	+ 9.8	11.7
193	Muslin: Wamsutta	10	+ 9.9	5.4
214	Underwear: union suits	5	+10.4	16.0
223	Linen shoe thread	5	+14.0	11.2
199	Cotton thread	4	+20.5	7.9
	Fuel and lighting			
239	Coke	11	+ .8	4.8
234	Anthracite coal: egg	5	+ 1.1	14.0
244	Matches	2	+ 2.0	2.0
247	Petroleum: crude	9	+ 2.4	7.3
248	Petroleum: refined, for export	8	+ 4.0	7.2
233	Anthracite coal: chestnut	6	+ 5.7	5.2
237	Bituminous coal: New River	10	+ 6.4 #	11.4
249	Petroleum: refined, 150° fire test	8	+ 7.7	12.5
232	Anthracite coal: broken	7	+ 8.7	11.2
238	Bituminous coal: Pocahontas	9	+ 9.2 #	10.1
235	Anthracite coal: stove	5	+10.0	8.4
236	Bituminous coal: Kanawha	10	+13.1 #	13.2
	Metals and metal products			
302	Zinc: slab	10	− 2.4	4.6
297	Lead: pipe	9	− .8	6.2
296	Lead: pig	11	− .5	6.3
293	Copper: ingot	11	− .2	7.5
300	Tin: pig	11	+ .1	4.5
295	Copper: wire	11	+ 1.3	6.2
299	Silver	9	+ 1.4	10.1
263	Pig iron: foundry No. 2, Southern	11	+ 1.5	3.4
301	Zinc: sheet	10	+ 1.7	8.8
267	Bar iron: from mill, Pittsburgh	11	+ 2.9	6.1
298	Quicksilver	10	+ 3.0	8.8
261	Pig iron: foundry No. 2, Northern	11	+ 3.1	4.6
294	Copper: sheet	10	+ 3.1	7.9
260	Pig iron: Bessemer	11	+ 3.2	5.2
266	Bar iron: from store, Phila.	11	+ 3.5	5.9

TABLE XV (Cont.)

(1) Ref. No.	(2) Commodity	(3) Number of price revivals	(4) Average deviation from reference date	(5) Measure of inconsistency
	Metals and metal products (cont.)			
276	Steel billets	11	+ 3.6	6.4
289	Wire: fence	10	+ 3.6	5.6
259	Pig iron: basic	11	+ 5.1	4.5
280	Steel rails	7	+ 5.3	11.5
291	Wood screws	9	+ 5.6	6.5
269	Nails: wire	10	+ 7.1	5.8
254	Files	4	+ 7.2	4.3
250	Augers	5	+ 7.4	12.5
251	Butts	9	+ 9.6	9.4
253	Door knobs	9	+ 9.6	12.5
272	Saws: crosscut	2	+10.5	2.5
288	Vises	9	+11.1	6.8
258	Locks	9	+12.2	10.7
274	Shovels	7	+12.3	12.8
252	Chisels	6	+13.3	6.6
273	Saws: hand	3	+13.3	4.0
255	Hammers	5	+13.6	5.9
287	Trowels	2	+22.0	9.0
271	Planes	3	+23.0	7.5
	Building materials			
348	Linseed oil	11	− 1.5	8.3
353	Turpentine: spirits of	10	− .7	11.2
338	Lime	5	− .6	6.8
327	Brick	10	0	6.0
321	Spruce	10	+ 2.2	10.9
345	Glass: window, B	11	+ 2.4	8.8
354	Lead: carbonate of	11	+ 2.6	11.7
344	Glass: window, A	10	+ 2.8	9.1
350	Rosin	10	+ 2.8	11.4
317	Pine: yellow siding	8	+ 3.6	5.5
323	Shingles: cypress	6	+ 3.7	11.2
352	Tar	9	+ 3.8	8.7
335	Doors	7	+ 6.3	9.8
306	Hemlock: N. Y.	8	+ 6.4	6.4
324	Shingles: red clear	9	+ 6.6	9.9
310	Oak: white plain, N. Y.	7	+ 7.3	8.6
355	Zinc: oxide of	11	+ 8.3	8.4
319	Poplar: N. Y.	10	+ 9.8	8.4
349	Putty	6	+10.0	5.8
312	Oak: white quartered, N. Y.	9	+11.0	11.2
308	Maple: N. Y.	8	+11.2	10.6
313	Pine: white boards	9	+12.1	9.1
	Chemicals and drugs			
393	Alcohol: grain	9	− 3.9	8.3
382	Tallow	11	− 1.6	5.9
362	Alcohol: wood	10	− 1.5	7.9
360	Acid: sulphuric	6	− 1.2	11.2
397	Opium	10	− .3	11.7
363	Alum	7	0	7.4
357	Acid: muriatic	5	+ .2	4.8
381	Sulphur	6	+ 1.8	12.0

TABLE XV (Conc.)

(1) Ref. No.	(2) Commodity	(3) Number of price revivals	(4) Average deviation from reference date	(5) Measure of inconsistency
	Chemicals and drugs (cont.)			
396	Glycerine	9	+ 4.6	10.8
400	Quinine	8	+11.0	7.2
377	Soda: bicarbonate of	6	+14.3	7.0
	House-furnishings			
419	Carpets: Wilton	9	+ 2.7	8.3
430	Tickings: Amoskeag	10	+ 3.8	8.3
418	Carpets: Brussels	9	+ 4.6	9.0
423	Sheeting: 10-4 Pepperell	11	+ 5.1	7.6
417	Carpets: Axminster	8	+ 5.9	4.3
422	Pails	5	+ 8.0	8.5
427	Tumblers	7	+ 8.9	13.6
406	Bedroom sets	7	+11.3	7.1
405	Bedroom chairs	6	+11.7	3.9
412	Kitchen chairs	9	+12.6	10.7
424	Sheeting: 10-4 Wamsutta	10	+13.6	9.4
428	Plates	4	+14.7	6.8
429	Teacups and saucers	4	+14.7	6.8
414	Kitchen tables	6	+16.7	7.5
431	Tubs	5	+19.4	10.6
426	Pitchers	6	+21.2	11.8
425	Nappies	2	+36.5	6.5
	Miscellaneous			
440	Leather: sole oak	11	— 1.2	5.9
451	Rubber	10	— .9	7.2
441	Leather: sole oak, scoured backs	10	— .8	4.5
436	Leather: calf	11	— .1	8.1
438	Leather: harness oak	11	+ .8	3.6
455	Starch: laundry	8	+ 1.1	7.7
433	Cottonseed meal	10	+ 1.4	5.7
450	Rope	11	+ 1.4	10.9
448	Jute	11	+ 1.6	9.1
444	Paper: wrapping, Manilla	8	+ 5.2	12.1
456	Tobacco: plug	4	+ 5.7	5.7
457	Tobacco: smoking	3	+10.7	12.7
443	Paper: newsprint	8	+12.2	13.0

‡The entry for period 17 which was affected by war-time price regulation has been omitted in computing this average.

TABLE XVI

Measures Describing the Behavior of Wholesale Commodity Prices during Periods of Revival and Recession in American Business, 1890–1925.

Ranking of Commodities, by Groups, according to the Average Duration of the Period of Rising Prices.[1]

(1) Ref. No.	(2) Commodity	(3) Average duration of period of rising prices (in months)
	Farm products	
49	*Onions	17.0
22	*Beans	18.3
44	*Hops	20.1
2	*Corn	20.4
16	Hogs: light	20.7
15	Hogs: heavy	21.2
1	*Barley	22.1
4	*Oats	22.2
51	*Potatoes	22.8
53	Rice	23.1
25	Cotton	23.2
5	*Rye	14.0
17	Sheep: ewes	24.5
37	*Hay	24.7 (21.7)
19	Sheep: wethers	24.8
42	Hides	24.9
47	Milk	25.5
14	Cattle: good to choice	25.7
59	Wool: medium	26.0 (22.9)
56	Wool: fine clothing	27.0 (24.0)
13	Cattle: choice to prime	27.1
34	*Flaxseed	34.5 (25.2)
31	*Eggs	34.7 (24.0)
6	*Wheat	34.8 (29.6)
	Foods	
130	Prunes	16.2
152	*Tea	16.9
128	*Apples	18.4
129	*Currants	18.4
109	Coffee	19.9
115	Mackerel	20.6
161	*Vinegar	20.9
119	*Flour: wheat, winter straights	21.0
74	Pork: cured, salt mess	21.1
158	Cottonseed oil	22.6
90	*Butter: creamery firsts, N. Y.	23.3
69	Hams	23.9
89	*Butter: creamery extra, N. Y.	24.0
95	*Butter: creamery extra, St. Louis	24.0

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[1] The main entries in this table are averages based upon all the recorded periods of rising prices. In computing the averages given in parentheses account has been taken only of those periods of rise which were limited to a single phase of revival (and prosperity).

*The commodities marked with an asterisk have price movements which are irregular, in the sense that they do not conform in any systematic fashion to the cyclical movements of general prices. For a more detailed explanation see text, pp. 81, 102.

TABLE XVI (Cont.)

(1) Ref. No.	(2) Commodity	(3) Average duration of period of rising prices (in months)
	Foods (cont.)	
117	*Flour: rye	24.1
75	Pork: cured, rough sides	24.3
64	Beef: fresh	24.4
76	Pork: cured, short clear sides	24.9
99	*Cheese	24.9
71	Mutton	25.1
145	Pepper	25.1 (23.1)
68	Beef: salt	25.3 (23.1)
120	*Flour: wheat, standard patents	25.9
149	*Sugar: raw	26.2
113	Cod	26.7
150	*Sugar: granulated	27.2
139	Meal: corn, fine white	27.4
146	*Salt	28.4 (21.7)
116	Salmon	28.6 (17.0)
138	Lard	28.9 (22.2)
140	Meal: corn, yellow table	29.1
141	Molasses	30.6 (22.8)
114	Herring	31.4 (22.5)
112	Crackers: soda	32.2 (20.8)
131	Raisins	34.1 (26.2)
111	Crackers: oyster	40.6 (27.5)
106	Bread: N. Y.	45.5 (18.0)
148	Starch: corn	51.5 (9.5)
104	Bread: Cincinnati	67.5 (32.0)
	Cloths and clothing	
179	Calico	19.0
181	Drillings: Pepperell	19.9
220	Worsted yarns: 2-32's	19.9
192	Muslin: Rough Rider	20.0
193	Muslin: Wamsutta	20.8
195	Print cloths	21.7
197	Sheetings: 4-4 Pepperell R-	22.5
202	Cotton yarns: carded, cones 10/1	22.6
196	Sheetings: 4-4 Indian Head	23.2
203	Cotton yarns: carded, cones 22/1	23.7
191	Muslin: Lonsdale	23.8
180	Denims	23.9
221	Worsted yarns: 2-40's	24.7
185	Ginghams: Amoskeag	25.0
198	Sheetings: 4-4 Ware Shoals	25.2 (20.2)
182	Drillings: Mass. D	25.8
186	Ginghams: Lancaster	25.8
190	Muslin: Fruit of the Loom	26.3
226	Silk: raw, Japanese, Kansai No. 1	26.5
183	Flannel: colored	27.0
184	Flannel: unbleached	27.0
228	Silk: raw, Japanese, extra-extra	27.1
173	Men's shoes: chocolate elk	28.3 (15.2)
217	Storm serge	29.0

*See footnote on page 558.

TABLE XVI (Cont.)

(1) Ref. No.	(2) Commodity	(3) Average duration of period of rising prices (in months)	
	Cloths and clothing (cont.)		
216	French serge	30.9	
206	Flannel: white	33.4	(27.0)
218	Poplar cloth	35.6	(35.0)
210	Suiting: Middlesex	37.8	(21.4)
215	Broadcloth	40.5	(21.5)
177	Women's shoes	40.8	(13.3)
219	Sicilian cloth	41.6	(30.0)
199	Cotton thread	44.3	(17.5)
166	Men's shoes: black calf	46.5	(8.5)
223	Linen shoe thread	75.0	(11.0)
174	Men's shoes: vici kid	91.0	(——)
213	Underwear: shirts and drawers	96.0	(24.0)
214	Underwear: union suits	141.5	(36.0)
	Fuel and lighting		
234	Anthracite coal: egg	11.0	
235	Anthracite coal: stove	11.5	
236	Bituminous coal: Kanawha	13.7	
238	Bituminous coal: Pocahontas	16.9	
233	Anthracite coal: chestnut	19.7	
239	Coke	20.7	
249	Petroleum: refined, 150° fire test	25.3	(22.7)
237	Bituminous coal: New River	27.9	(24.0)
248	Petroleum: refined, for export	29.4	(23.8)
247	Petroleum: crude	29.9	(25.0)
232	Anthracite coal: broken	61.2	(8.3)
244	Matches	85.0	(——)
	Metals and metal products		
259	Pig iron: basic	14.8	
295	Copper: wire	16.6	
261	Pig iron: foundry No. 2, Northern	16.7	
276	Steel billets	16.7	
260	Pig iron: Bessemer	17.3	
267	Bar iron: from mill, Pittsburgh	17.8	
293	Copper: ingot	18.6	
294	Copper: sheet	18.7	
263	Pig iron: foundry No. 2, Southern	19.2	
269	Nails: wire	19.6	
266	Bar iron: from store, Phila.	20.1	
302	Zinc: slab	20.1	
288	Vises	21.0	(16.1)
296	Lead: pig	22.1	
289	Wire: fence	22.3	
298	Quicksilver	23.0	
301	Zinc: sheet	23.0	(17.6)
300	Tin: pig	23.3	
291	Wood screws	23.8	
297	Lead: pipe	24.1	
253	Door knobs	24.2	(15.4)
299	Silver	25.6	(21.7)
258	Locks	26.2	(17.7)
274	Shovels	28.8	(18.6)

TABLE XVI (Cont.)

(1) Ref. No.	(2) Commodity	(3) Average duration of period of rising prices (in months)
	Metals and metal products (cont.)	
254	Files	30.3
251	Butts	32.0 (18.5)
252	Chisels	35.8 (15.0)
287	Trowels	49.0 (——)
271	Planes	50.7 (9.0)
280	Steel rails	57.6 (18.5)
255	Hammers	58.7 (15.5)
250	Augers	65.0 (32.5)
272	Saws: crosscut	66.0 (——)
273	Saws: hand	186.0 (——)
	Building materials	
319	Poplar: N. Y.	20.1
324	Shingles: red cedar	21.1 (15.6)
345	Glass: window, B	24.0
354	Lead: carbonate of	24.1
352	Tar	25.0
327	Brick	25.2 (20.0)
321	Spruce	25.3 (22.1)
348	Linseed oil	25.9
350	Rosin	26.0 (20.6)
349	Putty	26.3 (19.2)
344	Glass: window, A	28.2 (21.6)
355	Zinc: oxide of	28.2 (13.3)
335	Doors	28.3 (17.8)
313	Pine: white boards	28.4 (23.1)
312	Oak: white quartered, N. Y.	28.9 (23.9)
353	Turpentine: spirits of	28.9 (25.7)
308	Maple: N. Y.	35.0 (20.4)
306	Hemlock: N. Y.	38.3 (24.7)
310	Oak: white plain, N. Y.	38.7 (20.3)
323	Shingles: cypress	39.2 (29.7)
317	Pine: yellow siding	45.0 (23.3)
338	Lime	61.5 (9.0)
	Chemicals and drugs	
377	Soda: bicarbonate of	13.2
400	Quinine	16.5
382	Tallow	23.5
397	Opium	24.4
396	Glycerine	24.7
393	Alcohol: grain	25.9 (20.6)
357	Acid: muriatic	26.2 (16.7)
360	Acid: sulphuric	27.0 (20.0)
362	Alcohol: wood	30.8 (27.4)
381	Sulphur	47.7 (24.0)
363	Alum	62.8 (18.7)
	House-furnishings	
423	Sheeting: 10-4 Pepperell	23.0
430	Tickings: Amoskeag	23.9
427	Tumblers	24.6 (21.7)
424	Sheeting: 10-4 Wamsutta	25.1 (20.6)
426	Pitchers	26.8 (12.7)

TABLE XVI (Conc.)

(1) Ref. No.	(2) Commodity	(3) Average duration of period of rising prices (in months)
	House-furnishings (cont.)	
412	Kitchen chairs	31.9 (21.2)
417	Carpets: Axminster	32.3 (26.7)
419	Carpets: Wilton	47.5 (25.2)
406	Bedroom sets	48.0 (21.3)
418	Carpets: Brussels	48.2 (26.2)
405	Bedroom chairs	56.7 (23.5)
422	Pails	59.7 (10.5)
428	Plates	72.7 (24.0)
429	Teacups and saucers	72.7 (24.0)
431	Tubs	82.3 (13.0)
425	Nappies	84.0 (——)
414	Kitchen tables	134.0 (10.0)
	Miscellaneous	
433	Cottonseed meal	20.1 (15.1)
436	Leather: calf	20.1
443	Paper: newsprint	21.9
450	Rope	22.0
448	Jute	23.4
451	Rubber	23.7 (22.4)
440	Leather: sole oak	24.1
441	Leather: sole oak, scoured backs	26.2 (19.2)
438	Leather: harness oak	27.0 (19.1)
455	Starch: laundry	30.9 (19.4)
444	Paper: wrapping, Manila	36.0 (29.2)
456	Tobacco: plug	52.5 (50.0)
457	Tobacco: smoking	149.0 (——)

TABLE XVII

Measures Describing the Behavior of Wholesale Commodity Prices during Periods of Revival and Recession in American Business, 1890-1925.

Average Sequence of Recession, by Groups, with Measures of Inconsistency.[1]

The figures in column (4) indicate the number of months by which the price turns of specific commodities precede (—) or lag behind (+) the major turns of the general price index.

The measures in column (5) indicate the degree of reliability of the averages in column (4). The smaller the measure in column (5), the more consistent is the commodity in question in respect to the timing of its cyclical price movements.

(1) Ref. No.	(2) Commodity	(3) No. of price recessions	(4) Average deviation from reference date	(5) Measure of inconsistency
	Farm products			
6	*Wheat	6	—16.4	10.8
49	*Onions	10	—11.1	10.9
5	*Rye	8	—10.9	10.2
4	*Oats	9	— 6.6	10.9
1	*Barley	10	— 6.4	6.1
34	*Flaxseed	8	— 6.4	11.5
22	*Beans	10	— 6.2	12.0
42	Hides	10	— 5.7	3.1
59	Wool: medium	8	— 5.6	10.0
19	Sheep: wethers	10	— 4.9	4.9
56	Wool: fine clothing	8	— 4.6	9.9
15	Hogs: heavy	10	— 4.2	4.1
53	Rice	9	— 4.0	11.2
17	Sheep: ewes	10	— 3.9	3.3
16	Hogs: light	10	— 3.8	3.8
2	*Corn	9	— 3.7	9.8
44	*Hops	8	— 2.9	11.6
13	Cattle: choice to prime	10	— 1.5	5.5
14	Cattle: good to choice	10	— .7	6.2
31	*Eggs	8	+ 2.2	6.8
25	Cotton	10	+ 3.3	5.8
37	*Hay	8	+ 3.6	9.6
51	*Potatoes	10	+ 4.1	15.2
47	Milk	10	+ 5.7	7.6
	Foods			
129	*Currants	9	—10.7	10.9
152	*Tea	9	— 5.6	13.5
75	Pork: cured, rough sides	9	— 5.4	9.5
130	Prunes	10	— 5.4	10.8
76	Pork: cured, short clear sides	9	— 4.9	8.9
74	Pork: cured, salt mess	10	— 4.6	8.8

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[1] In computing the average time of recession, as given in this table, the entries for period 16 have been omitted. Because of war-time regulation and other abnormal conditions these entries are not considered to be representative.

*The commodities marked with an asterisk have price movements which are irregular, in the sense that they do not conform in any systematic fashion to the cyclical movements of general prices. For a more detailed explanation see text pp. 81, 102.

TABLE XVII (Cont.)

(1) Ref. No.	(2) Commodity	(3) No. of price recessions	(4) Average deviation from reference date	(5) Measure of inconsistency
	Foods (cont.)			
119	*Flour: wheat, winter straights	8	− 4.0	14.2
99	*Cheese	10	− 4.0	7.1
90	*Butter: creamery firsts, N. Y.	10	− 3.9	7.8
120	*Flour: wheat, standard patents	8	− 3.9	13.8
89	*Butter: creamery extra, N. Y.	10	− 3.3	7.4
95	*Butter: creamery extra, St. Louis	10	− 3.3	7.4
138	Lard	8	− 3.3	6.1
139	Meal: corn, fine white	9	− 3.0	8.5
145	Pepper	8	− 2.7	9.1
140	Meal: corn, yellow table	9	− 2.6	8.6
128	*Apples	9	− 1.5	13.5
158	Cottonseed oil	10	− .6	4.6
109	Coffee	10	+ .1	11.4
69	Hams	10	+ 1.1	6.5
64	Beef: fresh	10	+ 1.2	6.0
114	Herring	7	+ 1.3	6.0
71	Mutton	10	+ 1.8	8.8
68	Beef: salt	9	+ 1.9	7.3
113	Cod	9	+ 2.0	10.3
161	*Vinegar	10	+ 2.4	8.9
115	Mackerel	9	+ 2.5	7.5
112	Crackers: soda	6	+ 2.6	12.9
117	*Flour: rye	7	+ 3.2	15.1
146	*Salt	8	+ 3.5	11.4
148	Starch: corn	6	+ 5.0	8.2
141	Molasses	7	+ 5.1	8.3
131	Raisins	7	+ 5.4	6.1
111	Crackers: oyster	6	+ 5.8	14.7
116	Salmon	7	+ 8.2	9.6
149	*Sugar: raw	9	+ 8.4	8.7
106	Bread: N. Y.	5	+ 8.7	8.4
150	*Sugar: granulated	9	+ 9.0	9.4
104	Bread: Cincinnati	3	+10.0	4.0
	Cloths and clothing			
166	Men's shoes: black calf	4	− 3.3	4.0
173	Men's shoes: chocolate elk	7	− 2.4	4.5
177	Women's shoes	5	− 2.2	6.5
220	Worsted yarns: 2-32's	10	− 1.9	6.7
221	Worsted yarns: 2-40's	9	− 1.6	4.1
226	Silk: raw, Japanese, Kansai No. 1	10	− 1.6	5.4
215	Broadcloth	6	− .3	7.3
228	Silk: raw, Japanese, extra-extra	10	− .1	5.6
219	Sicilian cloth	6	.0	4.9
195	Print cloths	10	+ .9	7.0
174	Men's shoes: vici kid	2	+ 1.5	1.5
198	Calico	9	+ 2.0	3.0
179	Sheetings: 4-4 Ware Shoals	10	+ 2.1	7.4
216	French serge	7	+ 2.2	2.8
210	Suiting: Middlesex	7	+ 3.0	4.8

*See footnote on page 563.

TABLE XVII (Cont.)

(1) Ref. No.	(2) Commodity	(3) No. of price recessions	(4) Average deviation from reference date	(5) Measure of inconsistency
	Cloths and clothing (cont.)			
199	Cotton thread	4	+ 3.3	4.1
202	Cotton yarns: carded, cones 10/1	10	+ 3.7	6.2
217	Storm serge	8	+ 3.7	6.9
203	Cotton yarns: carded, cones 22/1	10	+ 4.2	6.9
182	Drillings: Mass. D	10	+ 4.8	5.9
192	Muslin: Rough Rider	10	+ 4.8	6.2
186	Ginghams: Lancaster	10	+ 4.9	7.3
190	Muslin: Fruit of the Loom	10	+ 5.7	5.6
181	Drillings: Pepperell	10	+ 5.9	5.5
191	Muslin: Lonsdale	10	+ 6.0	6.1
206	Flannels: white	8	+ 6.0	2.1
214	Underwear: union suits	2	+ 6.0	4.0
197	Sheetings: 4-4 Pepperell R	10	+ 6.3	7.0
185	Ginghams: Amoskeag	10	+ 6.4	7.7
180	Denims	10	+ 6.7	5.9
193	Muslin: Wamsutta	9	+ 7.4	4.4
213	Underwear: shirts and drawers	3	+ 8.5	1.5
183	Flannel: colored	8	+ 8.7	7.0
218	Poplar cloth	5	+ 8.7	7.2
223	Linen shoe thread	3	+ 8.7	7.4
196	Sheetings: 4-4 Indian Head	10	+ 9.2	6.2
184	Flannel: unbleached	9	+11.0	8.7
	Fuel and lighting			
239	Coke	10	— .5	7.6
232	Anthracite coal: broken	4	+ 1.3	5.2
236	Bituminous coal: Kanawha	10	+ 2.2	5.0
238	Bituminous coal: Pocahontas	8	+ 3.0	5.4
234	Anthracite coal: egg	2	+ 4.5	8.5
235	Anthracite coal: stove	2	+ 4.5	8.5
244	Matches	2	+ 6.0	12.0
248	Petroleum: refined, for export	7	+ 6.1	5.3
233	Anthracite coal: chestnut	3	+ 6.3	7.4
249	Petroleum: refined, 150° fire test	7	+ 6.3	7.3
237	Bituminous coal: New River	8	+ 6.7	6.5
247	Petroleum: crude	8	+ 6.9	8.4
	Metals and metal products			
295	Copper: wire	10	— 4.2	5.4
267	Bar iron: from mill, Pittsburgh	10	— 4.0	7.7
293	Copper: ingot	10	— 3.7	5.4
302	Zinc: slab	9	— 3.7	6.2
259	Pig iron: basic	10	— 2.2	4.8
261	Pig iron: foundry No. 2, Northern	10	— 2.2	4.1
263	Pig iron: foundry No. 2, Southern	10	— 2.0	4.5
276	Steel billets	10	— 2.0	2.9
294	Copper: sheet	9	— 1.2	5.7
260	Pig iron: Bessemer	10	— 1.1	3.7
297	Lead: pipe	8	— 1.0	5.1
301	Zinc: sheet	8	— .9	7.3
296	Lead: pig	10	— .4	6.4
266	Bar iron: from store, Phila.	10	— .3	4.2

TABLE XVII (Cont.)

(1) Ref. No.	(2) Commodity	(3) No. of price recessions	(4) Average deviation from reference date	(5) Measure of inconsistency
	Metals and metal products (cont.)			
299	Silver	8	— .2	9.0
300	Tin: pig	10	+ .4	7.4
289	Wire: fence	9	+ 2.2	5.0
298	Quicksilver	9	+ 2.4	5.0
288	Vises	8	+ 3.9	7.3
271	Planes	4	+ 4.0	8.4
269	Nails: wire	9	+ 4.2	5.8
253	Door knobs	8	+ 5.0	7.5
254	Files	3	+ 5.5	1.5
280	Steel rails	5	+ 5.5	5.7
252	Chisels	6	+ 6.2	5.0
274	Shovels	7	+ 6.5	6.7
291	Wood screws	10	+ 6.9	7.1
251	Butts	7	+ 7.3	5.4
250	Augers	5	+ 7.6	5.5
258	Locks	9	+11.2	7.2
272	Saws: crosscut	1	+13.0	0
273	Saws: hand	1	+13.0	0
255	Hammers	4	+13.2	8.8
287	Trowels	1	+14.0	0
	Building materials			
323	Shingles: cypress	5	— 2.6	2.4
327	Brick	9	— 2.4	9.5
317	Pine: yellow siding	5	— 1.4	3.2
335	Doors	7	— .7	3.5
338	Lime	5	+ .2	14.5
324	Shingles: red cedar	8	+ .3	9.8
350	Rosin	9	+ .6	9.3
345	Glass: window, B	10	+ 1.0	11.4
353	Turpentine: spirits of	9	+ 1.0	5.6
348	Linseed oil	10	+ 1.2	8.1
310	Oak: white, plain, N. Y.	6	+ 1.3	5.4
344	Glass: window, A	9	+ 1.4	12.1
355	Zinc: oxide of	8	+ 3.0	8.6
352	Tar	8	+ 3.6	9.1
306	Hemlock: N. Y.	6	+ 4.2	3.8
354	Lead: carbonate of	10	+ 4.3	7.5
319	Poplar	9	+ 5.2	7.0
349	Putty	6	+ 6.2	8.1
308	Maple: N. Y.	6	+ 6.8	4.5
321	Spruce	9	+ 7.8	4.7
313	Pine: white boards	8	+ 9.1	5.5
312	Oak: white quartered, N. Y.	9	+13.0	6.7
	Chemicals and drugs			
381	Sulphur	4	—10.3	9.9
393	Alcohol: grain	8	— 6.8	7.2
360	Acid: sulphuric	6	— 5.8	12.5
382	Tallow	10	— 1.8	5.3
357	Acid: muriatic	5	— 1.2	4.6
397	Opium	9	+ .2	12.2
362	Alcohol: wood	9	+ 2.5	7.0

TABLE XVII (Conc.)

(1) Ref. No.	(2) Commodity	(3) No. of price recessions	(4) Average deviation from reference date	(5) Measure of inconsistency
	Chemicals and drugs (cont.)			
400	Quinine	8	+3.1	9.5
377	Soda: bicarbonate of	7	+5.3	4.5
396	Glycerine	8	+7.0	4.7
363	Alum	5	+10.5	5.0
	House-furnishings			
419	Carpets: Wilton	6	+2.0	8.7
425	Nappies	3	+3.7	2.3
418	Carpets: Brussels	6	+3.8	8.4
423	Sheeting: 10-4 Pepperell	10	+3.8	6.2
427	Tumblers	8	+4.3	8.3
406	Bedroom sets	5	+5.0	2.1
430	Tickings: Amoskeag	10	+5.3	6.6
414	Kitchen tables	4	+5.5	3.2
431	Tubs	4	+5.5	8.4
417	Carpets: Axminster	7	+7.0	3.6
422	Pails	5	+7.6	5.1
424	Sheeting: 10-4 Wamsutta	8	+8.0	5.0
405	Bedroom chairs	4	+8.7	3.2
426	Pitchers	7	+9.3	8.9
428	Plates	3	+11.3	7.4
429	Teacups and saucers	3	+11.3	7.4
412	Kitchen chairs	8	+11.7	7.4
	Miscellaneous			
451	Rubber	9	−6.4	9.9
433	Cottonseed meal	9	−4.9	7.1
436	Leather: calf	10	−1.6	8.9
441	Leather: sole oak, scoured backs	9	−1.5	6.8
450	Rope	10	+.3	3.7
438	Leather: harness oak	9	+.6	7.5
455	Starch: laundry	7	+.7	4.9
440	Leather: sole oak	10	+.9	6.1
448	Jute	10	+2.8	8.1
457	Tobacco: smoking	2	+4.0	5.0
456	Tobacco: plug	5	+4.8	9.9
443	Paper: newsprint	8	+10.0	7.2
444	Paper: wrapping, Manila	7	+14.0	9.1

TABLE XVIII

MEASURES DESCRIBING THE BEHAVIOR OF WHOLESALE COMMODITY PRICES DURING PERIODS OF REVIVAL AND RECESSION IN AMERICAN BUSINESS, 1890-1925.

Ranking of Commodities, by Groups, according to the Average Duration of the Period of Falling Prices.[1]

(1) Ref. No.	(2) Commodity	(3) Average duration of period of falling prices (in months)
	Farm products	
13	Cattle: choice to prime	9.9
47	Milk	12.9
14	Cattle: good to choice	13.2
19	Sheep: wethers	13.2
31	*Eggs	13.2
42	Hides	13.4
17	Sheep: ewes	13.7
34	*Flaxseed	14.9
1	*Barley	15.2
51	*Potatoes	16.3
25	Cotton	16.5
59	Wool: medium	17.5
15	Hogs: heavy	17.6
16	Hogs: light	17.7
4	*Oats	19.0
2	*Corn	19.2
22	*Beans	20.1
49	*Onions	20.4
53	Rice	20.4 (18.6)
5	*Rye	20.7 (18.6)
56	Wool: fine clothing	20.7 (13.7)
6	*Wheat	22.0 (18.8)
37	*Hay	22.1
44	*Hops	27.4 (21.8)
	Foods	
140	Meal: corn, yellow table	11.2
106	Bread: N. Y.	12.0
139	Meal: corn, fine white	12.9
71	Mutton	14.4
99	*Cheese	14.4
64	Beef: fresh	14.5
69	Hams	15.8
89	*Butter: creamery extra, N. Y.	15.8
95	*Butter: creamery extra, St. Louis	15.8
158	Cottonseed oil	15.9
68	Beef: salt	16.1
90	*Butter: creamery firsts, N. Y.	16.6
74	Pork: cured, salt mess	17.0

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[1] The main entries in this table are averages based upon all the recorded periods of falling price. In computing the averages given in parentheses account has been taken only of those periods of decline which were limited to a single phase of recession (and depression).

*The commodities marked with an asterisk have price movements which are irregular, in the sense that they do not conform in any systematic fashion to the cyclical movements of general prices. For a more detailed explanation see text, pp. 81, 102.

TABLE XVIII (Cont.)

(1) Ref. No.	(2) Commodity	(3) Average duration of period of falling prices (in months)
	Foods (cont.)	
120	*Flour: wheat, standard patents	17.2 (14.3)
146	*Salt	17.5
109	Coffee	17.7
150	*Sugar: granulated	17.7 (16.1)
149	*Sugar: raw	18.1 (16.6)
76	Pork: cured, short clear sides	19.0 (16.1)
75	Pork: cured, rough sides	19.9 (17.0)
113	Cod	20.9 (16.7)
131	Raisins	20.9 (17.5)
138	Lard	21.0 (18.0)
115	Mackerel	21.3
129	*Currants	21.4
111	Crackers: oyster	21.7 (10.7)
152	*Tea	21.9
114	Herring	22.1 (17.4)
119	*Flour: wheat, winter straights	22.1 (19.9)
145	Pepper	22.6 (15.4)
116	Salmon	22.7
130	Prunes	22.9
128	*Apples	23.4 (22.1)
141	Molasses	23.7
112	Crackers: soda	24.0 (11.2)
161	*Vinegar	24.8 (18.4)
117	*Flour: rye	25.9 (19.8)
148	Starch: corn	29.4 (17.2)
104	Bread: Cincinnati	59.0 (4.0)
	Cloths and clothing	
206	Flannel: white	11.1
184	Flannel: unbleached	11.6
190	Muslin: Fruit of the Loom	11.9
228	Silk: raw, Japanese, extra-extra	11.9
183	Flannel: colored	12.0
226	Silk: raw, Japanese, Kansai, No. 1	12.6
182	Drillings: Mass. D	13.4
191	Muslin: Lonsdale	14.2
186	Ginghams: Lancaster	14.9
180	Denims	15.8
185	Ginghams: Amoskeag	16.0
196	Sheetings: 4-4 Indian Head	16.6
192	Muslin: Rough Rider	16.8
203	Cotton yarns: carded, cones 22/1	17.1
174	Men's shoes: vici kid	17.5
197	Sheetings: 4-4 Pepperell R	17.5
220	Worsted yarns: 2-32's	18.2
202	Cotton yarns: carded, cones 10/1	18.3
217	Storm serge	18.7 (14.1)
221	Worsted yarns: 2-40's	18.7 (14.5)
193	Muslin: Wamsutta	18.8

*See footnote on page 568.

TABLE XVIII (Cont.)

(1) Ref. No.	(2) Commodity	(3) Average duration of period of falling prices (in months)
	Cloths and clothing (cont.)	
198	Sheetings: 4-4 Ware Shoals	18.9
195	Print cloths	19.0
181	Drillings: Pepperell	19.4
215	Broadcloth	19.5 (15.2)
218	Poplar cloth	20.2 (14.0)
210	Suiting: Middlesex	21.1 (15.7)
173	Men's shoes: chocolate elk	22.7
216	French serge	23.1 (16.0)
179	Calico	24.4 (19.7)
166	Men's shoes: black calf	25.5
219	Sicilian cloth	25.8 (14.0)
177	Women's shoes	26.6
213	Underwear: shirts and drawers	28.7 (13.0)
214	Underwear: union suits	47.5 (23.0)
199	Cotton thread	49.2 (32.3)
223	Linen shoe thread	49.7 (35.0)
	Fuel and lighting	
247	Petroleum: crude	16.7 (14.7)
239	Coke	17.2
248	Petroleum: refined, for export	19.9 (17.2)
233	Anthracite coal: chestnut	21.0
232	Anthracite coal: broken	23.0
237	Bituminous coal: New River	23.7 (13.7)
249	Petroleum: refined, 150° fire test	24.0 (22.5)
236	Bituminous coal: Kanawha	25.2
235	Anthracite coal: stove	31.0
238	Bituminous coal: Pocahontas	31.1 (21.7)
234	Anthracite coal: egg	33.0
244	Matches	81.0 (7.0)
	Metals and metal products	
272	Saws: crosscut	15.0
273	Saws: hand	15.0
297	Lead: pipe	15.6
300	Tin: pig	15.6
296	Lead: pig	15.8
291	Wood screws	16.7
289	Wire: fence	17.1
298	Quicksilver	18.4 (13.4)
299	Silver	18.5
280	Steel rails	18.6
258	Locks	19.0
287	Trowels	19.0
266	Bar iron: from store, Phila.	19.1
302	Zinc: slab	19.1
263	Pig iron: foundry No. 2, Southern	19.3
250	Augers	19.5 (12.7)
294	Copper: sheet	20.0
293	Copper: ingot	20.2
260	Pig iron: Bessemer	20.7

TABLE XVIII (Cont.)

(1) Ref. No.	(2) Commodity	(3) Average duration of period of falling prices (in months)
	Metals and metal products (cont.)	
301	Zinc: sheet	20.7
261	Pig iron: foundry No. 2, Northern	21.1
267	Bar iron: from mill, Pittsburgh	21.3
276	Steel billets	21.4
295	Copper: wire	22.4
253	Door knobs	22.7
269	Nails: wire	22.8 (18.7)
259	Pig iron: basic	23.0
251	Butts	23.1 (19.0)
274	Shovels	24.7 (24.3)
255	Hammers	28.7 (18.3)
288	Vises	28.9 (24.9)
252	Chisels	30.2 (24.4)
271	Planes	56.3 (39.0)
254	Files	70.3 (16.0)
	Building materials	
348	Linseed oil	12.6
308	Maple: N. Y.	14.0
353	Turpentine: spirits of	14.0
354	Lead: carbonate of	14.9
312	Oak: white quartered, N. Y.	15.4
345	Glass: window, B	15.9
344	Glass: window, A	16.1
350	Rosin	16.2
352	Tar	17.4
306	Hemlock: N. Y.	17.5
338	Lime	17.7
321	Spruce	18.3
327	Brick	18.3
317	Pine: yellow siding	19.4
313	Pine: white boards	20.0 (12.7)
323	Shingles: cypress	20.2
355	Zinc: oxide of	22.1
319	Poplar: N. Y.	22.8 (18.0)
324	Shingles: red cedar	26.2 (20.1)
310	Oak: white plain, N. Y.	27.3 (21.0)
335	Doors	28.3 (23.2)
349	Putty	34.8 (16.7)
	Chemicals and drugs	
363	Alum	10.4
362	Alcohol: wood	13.4
382	Tallow	14.8
397	Opium	14.8
393	Alcohol: grain	18.6
396	Glycerine	18.6 (12.0)
400	Quinine	28.3 (22.7)
381	Sulphur	39.7 (23.3)
350	Acid: sulphuric	46.4 (21.7)
357	Acid: muriatic	53.5 (18.7)
377	Soda: bicarbonate of	57.8 (22.0)

TABLE XVIII (Conc.)

(1) Ref. No.	(2) Commodity	(3) Average duration of period of falling prices (in months)	
	House-furnishings		
430	Tickings: Amoskeag	14.8	
423	Sheeting: 10-4 Pepperell	15.8	
406	Bedroom sets	16.7	
418	Carpets: Brussels	19.5	(10.8)
419	Carpets: Wilton	19.8	(10.6)
424	Sheeting: 10-4 Wamsutta	20.0	
417	Carpets: Axminster	22.3	(13.2)
422	Pails	24.2	(16.0)
412	Kitchen chairs	26.0	(19.8)
405	Bedroom chairs	27.3	(19.5)
431	Tubs	35.7	(20.3)
426	Pitchers	36.0	(31.2)
414	Kitchen tables	43.5	(21.0)
428	Plates	53.0	(19.0)
429	Teacups and saucers	53.0	(19.0)
427	Tumblers	56.6	(12.5)
425	Nappies	66.0	(60.0)
	Miscellaneous		
457	Tobacco: smoking	9.0	
444	Paper: wrapping, Manila	14.0	(10.0)
440	Leather: sole oak	14.8	
448	Jute	15.2	
441	Leather: sole oak, scoured backs	15.7	
438	Leather: harness oak	15.7	
450	Rope	16.8	
443	Paper: newsprint	17.3	
436	Leather : calf	19.6	
451	Rubber	20.0	
433	Cottonseed meal	22.2	
455	Starch: laundry	22.3	(19.8)
456	Tobacco: plug	42.3	(13.5)

TABLE XIX

Measures Descriptive of Frequency Distributions of Unweighted Fixed Base Relatives of Commodity Prices at Wholesale, in the United States, 1891-1926[1]

(Arithmetic Measures)

(1) Year	(2) Mean	(3) Median	(4) Standard deviation	(5) $\frac{.6745\sigma}{M}$ x100	(6) β_1	(7) β_2	(8) Skewness[2]	(9) Kurtosis	(10) κ_1	(11) κ_2	(12) r	(13) Pearsonian curve type
1891	100.0	100.0										
1892	95.4	95.9	10.20	7.2	.0324	4.6774	—.0487	1.6774	3.2576	.0079	6.7135	IV
1893	95.1	95.5	15.42	10.9	1.8537	7.5394	—.4082	4.5394	3.5177	.5949	7.9922	IV
1894	85.7	87.2	14.54	11.4	.0047	3.4728	—.0266	.4728	.9315	.0038	15.8976	IV
1895	84.3	83.5	16.03	12.8	2.7955	14.9681	.3061	11.9681	15.5497	.2818	4.3110	IV
1896	81.5	81.9	16.91	14.0	.1349	6.7421	—.0749	3.7421	7.0795	.0170	4.7522	IV
1897	81.0	81.8	15.77	13.1	.0324	3.1449	—.0847	.1449	.1926	.1272	65.8100	IV
1898	84.9	83.9	17.84	14.2	.7484	5.9207	.2395	2.9207	3.5962	.1931	6.9612	IV
1899	92.5	91.0	20.82	15.2	.4491	5.1119	.1960	2.1119	2.8765	.1345	7.6401	IV
1900	100.1	99.1	23.34	15.7	.3242	4.8728	.1670	1.8728	2.7730	.0978	7.6782	IV
1901	99.2	97.6	24.26	16.5	.9128	5.4111	.3194	2.4111	2.0838	.4098	10.0728	IV
1902	102.8	98.7	25.56	16.8	.8695	5.6831	.2851	2.6831	2.7577	.2953	8.2973	IV

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[1] The numbers of price quotations for the different years were as follows:

1891-1902: 195
1902-1913: 205
1913-1917: 391
1918: 389
1919-1922: 391
1923-1924: 390
1925: 387
1926: 385

The eight tables following (XIX to XXVII) are based on the same price quotations, with two minor exceptions in the case of link relatives.

[2] A measure of skewness, derived after Pearson's formula, has been included for each of the distributions in these tables. Since ideal J curves are modeless, the term skewness has not the same significance for these distributions as it has for distributions with true modes.

TABLE XIX (Cont.)

(1) Year	(2) Mean	(3) Median	(4) Standard deviation	(5) $\frac{.6745\sigma}{M}$ x100	(6) β_1	(7) β_2	(8) Skewness	(9) Kurtosis	(10) κ_1	(11) κ_2	(12) r	(13) Pearsonian-curve type
1902	100.0	100.0										
1903	101.3	101.6	11.34	7.6	.1171	3.8010	—.1251	.8010	1.2507	.0729	12.8755	IV
1904	101.6	101.0	17.49	11.6	.1826	4.1786	.1420	1.1786	1.8094	.0804	9.9348	IV
1905	103.0	102.9	19.20	12.6	.8820	7.0173	.2262	4.0173	5.3886	.1615	5.7180	IV
1906	109.0	108.0	22.36	13.8	2.0503	10.2442	.3169	7.2442	8.3375	.3096	5.1770	IV
1907	115.1	114.6	23.98	14.0	1.9982	10.6027	.3002	7.6027	9.2108	.2756	4.9536	IV
1908	106.8	109.0	20.23	13.8	.0552	5.5577	—.0545	2.5577	4.9498	.0093	5.4578	IV
1909	109.9	112.3	22.10	13.6	.4259	6.6789	—.1446	3.6789	6.0801	.0645	5.1838	IV
1910	115.2	115.7	28.51	16.7	5.9280	18.9393	—.5328	15.9393	14.0946	.8730	5.1131	IV
1911	113.1	110.8	34.23	20.4	13.6001	31.5601	.9483	28.5601	16.3199	2.9124	6.2353	$\mathrm{VI_J}$
1912	116.6	114.6	33.59	19.4	15.0925	33.2958	1.0535	30.2958	15.3141	3.6924	6.7402	$\mathrm{VI_J}$
1913	116.7	116.3	28.55	16.5	2.9179	10.9979	.4198	7.9979	7.2421	.5601	5.8657	IV
1913	100.0	100.0										
1914	100.0	99.6	13.05	8.8	8.9019	23.5430	.7160	20.5430	14.3804	1.6161	5.6591	VI
1915	110.1	100.4	71.05	43.5	118.4667	139.3550	33.6462	136.3550	—82.6901	—35.9281	—1.4431	$\mathrm{I_J}$
1916	142.5	121.0	131.37	62.2	164.2497	200.3467	180.0956	197.3467	—98.0557	—56.1044	—2.1476	$\mathrm{I_J}$
1917	190.5	171.2	135.38	47.9	147.4448	192.4489	17.3041	189.4489	—63.4366	—67.7854	—4.1620	$\mathrm{I_J}$
1918	214.7	192.3	119.27	37.5	126.6821	148.1861	30.2116	145.1861	—89.6741	—37.9532	—1.3719	$\mathrm{I_J}$
1919	218.4	208.9	70.63	21.8	29.6149	68.2365	1.2546	65.2365	41.6283	4.9024	5.4225	$\mathrm{VI_J}$
1920	245.3	229.3	81.44	22.4	1.7070	7.4701	.3777	4.4701	3.8192	.4947	7.4829	IV
1921	160.2	154.7	52.44	22.1	.6937	4.9142	.2889	1.9142	1.7473	.3537	11.0588	IV
1922	154.5	151.5	44.56	19.4	.2572	3.6644	.2172	.6644	.5572	.3691	25.9210	IV
1923	164.8	159.9	48.18	19.7	.1736	3.3765	.1942	.3765	.2322	.5852	56.9225	IV
1924	162.8	156.3	48.73	20.2	1.0214	6.2636	.2891	3.2636	3.4630	.2877	7.3500	IV
1925	167.7	165.1	44.99	18.1	.5460	5.0558	.2289	2.0558	2.4736	.1927	8.5134	IV
1926	161.1	156.0	45.60	19.1	.7909	5.4141	.2808	2.4141	2.4555	.2956	8.8533	IV

TABLE XX

MEASURES DESCRIPTIVE OF FREQUENCY DISTRIBUTIONS OF WEIGHTED FIXED BASE RELATIVES OF COMMODITY PRICES AT WHOLESALE, IN THE UNITED STATES, 1891-1926[1]

(Arithmetic Measures)

(1) Year	(2) Mean	(3) Median	(4) Standard deviation	(5) $\frac{.6745\sigma}{M}$ x100	(6) β_1	(7) β_2	(8) Skewness	(9) Kurtosis	(10) κ_1	(11) κ_2	(12) r	(13) Pearsonian curve type
1891	100.0	100.0										
1892	95.1	94.3	10.21	7.2	.0478	4.0726	.0698	1.0726	2.0018	.0185	9.0662	IV
1893	97.4	97.1	18.53	12.8	1.9758	5.9890	.6950	2.9890	.0506	43.7514	357.2964	VI
1894	87.3	88.3	16.31	12.6	.0101	3.1859	—.0453	.1859	.3415	.0223	38.2278	IV
1895	89.6	87.8	22.54	17.0	8.1685	15.2603	1.4267	12.2603	.0151	1234.2275	2420.5828	VIJ
1896	85.1	84.1	20.31	16.1	2.8532	10.1647	.4501	7.1647	5.7698	.6675	6.5633	IV
1897	85.2	85.4	14.69	11.6	.1606	3.8359	—.1486	.8359	1.1900	.1061	13.4889	IV
1898	88.1	88.7	16.70	12.8	.1307	3.8940	—.1287	.8940	1.3959	.0733	11.8775	IV
1899	94.8	93.6	23.87	17.0	2.3919	7.7648	.5380	4.7648	2.3539	1.2326	11.1463	VI
1900	102.9	102.4	24.53	16.1	1.6901	7.6508	.3622	4.6508	4.2313	.4437	7.0343	IV
1901	102.2	100.5	23.53	15.5	.8989	5.1518	.3400	2.1518	1.6069	.5189	12.1460	IV
1902	109.7	104.2	29.45	18.1	1.2688	5.3091	.4711	2.3091	.8118	1.5488	22.4708	VI
1902	100.0	100.0										
1903	102.3	102.4	13.89	9.2	.0381	2.7290	—.1266	—.2710	—.6563	—.0441	—15.4585	I
1904	103.8	102.7	21.50	14.0	.1170	2.1737	.7586	—.8263	—2.0036	—.0468	—3.1644	I
1905	103.7	104.9	20.69	13.5	.3019	3.4700	—.2719	.4700	.0343	7.0995	379.2595	VI
1906	106.6	106.2	19.93	12.6	.4866	4.9688	.2151	1.9688	2.4778	.1693	8.4321	IV
1907	113.5	113.8	20.63	12.3	.4219	5.1828	—.1848	2.1828	3.0999	.1170	7.2794	IV
1908	108.6	109.7	19.50	12.1	.0015	3.0008	—.0194	.0008	—.0029	—.3879	-4136.4827	I
1909	116.3	113.6	23.52	13.6	.4003	4.8273	.1944	1.8273	2.4537	.1380	8.3800	IV
1910	120.3	117.2	28.39	15.9	2.1593	9.7736	.3487	6.7736	7.0693	.3820	5.6138	IV
1911	113.3	111.0	24.85	14.8	2.6761	18.4569	.2611	15.4569	22.8855	.2045	3.8751	IV
1912	119.6	123.5	24.00	13.5	2.3591	20.8577	—.2258	17.8577	28.6381	.1535	3.6661	IV
1913	120.9	123.1	24.91	13.9	.6017	6.1958	—.1942	3.1958	4.5865	.1207	6.0099	IV

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[1] See footnote to Table XIX concerning the number of price quotations.

TABLE XX (Cont.)

(1) Year	(2) Mean	(3) Median	(4) Standard deviation	(5) $\frac{.6745\sigma}{M}$ x100	(6) β_1	(7) β_2	(8) Skewness	(9) Kurtosis	(10) κ_1	(11) κ_2	(12) r	(13) Pearsonian curve type
1913	100.0	100.0										
1914	98.3	99.3	10.28	7.1	.0572	8.9118	—.0405	5.9118	11.6520	.0049	4.0446	IV
1915	100.6	97.9	32.17	21.6	357.4706	574.8087	7.5842	571.8087	71.2056	341.5485	18.2293	VI_J
1916	127.8	118.2	42.96	22.7	330.8562	765.6991	3.8112	762.6991	532.8296	44.3083	4.8853	VI_J
1917	180.1	174.6	61.40	23.0	41.8122	194.7847	.8955	191.7847	258.1328	2.4233	3.5324	VI_J
1918	198.5	187.7	56.40	19.2	26.0769	153.2418	.6641	150.2418	222.2529	1.3134	3.4060	VI
1919	211.8	207.9	51.39	16.4	1.0105	13.8801	.1561	10.8801	18.7287	.0732	3.8026	IV
1920	236.7	223.2	71.35	20.3	.6192	4.6257	.2881	1.6257	1.3938	.3880	12.9423	IV
1921	155.0	151.9	48.78	21.2	1.0307	7.0034	.2560	4.0034	4.9147	.2105	6.0708	IV
1922	155.0	156.0	42.37	18.4	.2059	4.3653	—.1442	1.3653	2.1129	.0785	8.9717	IV
1923	162.8	160.3	45.43	18.8	.0238	3.0730	.0753	.0730	.0746	.2407	164.8150	IV
1924	157.9	152.5	43.29	18.5	.4914	5.4967	.1917	2.4967	3.5192	.1229	6.8287	IV
1925	164.1	162.5	39.33	16.2	1.0430	6.7671	.2685	3.7671	4.4052	.2359	6.4343	IV
1926	156.4	152.1	41.82	18.0	.9397	6.1209	.2769	3.1209	3.4227	.2636	7.3296	IV

TABLE XXI

MEASURES DESCRIPTIVE OF FREQUENCY DISTRIBUTIONS OF UNWEIGHTED FIXED BASE RELATIVES OF COMMODITY PRICES AT WHOLESALE, IN THE UNITED STATES, 1913-1926[1]

(Geometric and Logarithmic Measures)[2]

(1) Year	(2) Mean	(3) Median	(4) Standard deviation	(5) Coefficient of variation	(6) Index of dispersion[3]	(7) β_1	(8) β_2	(9) Skewness	(10) Kurtosis	(11) κ_1	(12) κ_2	(13) r	(14) Pearsonian curve type
1913	100.0	100.0											
1914	99.2	99.6	.0525	2.63	8.2	.9344	10.4054	—.1731	7.4054	12.0077	.0901	4.2328	IV
1915	104.0	100.3	.1147	5.69	17.9	17.3358	33.1633	1.4258	30.1633	8.3192	8.4480	10.6939	VI_J
1916	130.3	122.4	.1416	6.69	22.2	13.8397	23.6492	1.8914	20.6492	—.2207	—209.8989	—239.4525	I_J
1917	176.3	171.0	.1507	6.71	23.7	2.8356	12.6623	.3536	9.6623	10.8179	.3814	4.8956	IV
1918	202.1	194.4	.1390	6.03	21.8	1.6231	11.2838	.2415	8.2838	11.6984	.1758	4.4420	IV
1919	210.7	208.8	.1174	5.05	18.4	.0429	7.1791	.0396	4.1791	8.2294	.0047	4.4738	IV
1920	233.0	229.5	.1417	5.99	22.2	.1385	5.5534	.0887	2.5534	4.6914	.0248	5.6464	IV
1921	151.6	154.7	.1490	6.83	23.3	.5101	5.4174	—.2001	2.4174	3.3044	.1358	7.0947	IV
1922	147.7	150.9	.1328	6.12	20.8	.7139	6.5537	—.2071	3.5537	4.9656	.1363	5.8479	IV
1923	158.1	161.9	.1356	6.17	21.2	.4453	4.5713	—.2259	1.5713	1.8067	.2084	10.3813	IV
1924	155.4	156.6	.1341	6.12	21.0	.4564	6.1944	—.1615	3.1944	5.0197	.0821	5.6633	IV
1925	161.3	164.9	.1200	5.43	18.8	.2115	4.0400	—.1630	1.0400	1.4457	.1167	11.7396	IV
1926	154.7	156.0	.1249	5.70	19.0	.2473	4.7307	—.1460	1.7307	2.7194	.0747	7.6856	IV

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[1] See footnote to Table XIX concerning the number of price quotations.

[2] All measures in this table have been computed from the logarithms of relative prices. The averages and the indexes of dispersion given in the tables are the antilogarithms of the corresponding logarithmic measures. The standard deviations and the coefficients of variation are given as derived directly from the logarithms The criteria of curve type relate to the logarithmic distributions.

[3] See page 257 for an explanation of the index of dispersion.

TABLE XXII

MEASURES DESCRIPTIVE OF FREQUENCY DISTRIBUTIONS OF WEIGHTED FIXED BASE RELATIVES OF COMMODITY PRICES AT WHOLESALE, IN THE UNITED STATES, 1913-1926[1]

(Geometric and Logarithmic Measures)[2]

(1) Year	(2) Mean	(3) Median	(4) Standard deviation	(5) Coefficient of variation	(6) Index of dispersion[3]	(7) β_1	(8) β_2	(9) Skewness	(10) Kurtosis	(11) κ_1	(12) κ_2	(13) r	(14) Pearsonian curve type
1913	100.0	100.0											
1914	97.9	99.7	.0473	2.38	7.4	.4060	5.4619	—.1698	2.4619	3.7058	.0951	6.5668	IV
1915	98.6	98.2	.0809	4.06	12.6	3.7025	22.2292	.3037	19.2292	27.3508	.2768	3.8448	IV
1916	124.6	118.4	.0935	4.46	14.6	3.0788	13.1573	.3700	10.1573	11.0780	.4180	4.9170	IV
1917	172.2	170.8	.1288	5.76	20.1	.0899	4.3698	.0898	1.3698	2.4697	.0287	7.9682	IV
1918	192.2	189.2	.1160	5.08	18.1	.0205	5.0962	.0354	2.0962	4.1181	.0040	5.9383	IV
1919	205.2	205.2	.1101	4.76	17.8	.5279	6.1388	—.1792	3.1388	4.6940	.1022	5.8939	IV
1920	225.3	223.6	.1382	5.87	21.6	1.3540	9.3309	.2429	6.3309	8.5999	.1799	4.8677	IV
1921	146.6	151.5	.1499	6.92	23.5	1.6704	9.2122	—.2919	6.2122	7.4132	.2639	5.2947	IV
1922	147.8	152.3	.1336	6.16	21.0	3.3579	13.2803	—.4004	10.2803	10.4869	.4929	5.1049	IV
1923	155.8	161.2	.1372	6.26	21.5	1.4547	6.9868	—.3500	3.9868	3.6095	.4261	7.5336	IV
1924	152.3	153.3	.1337	6.13	21.0	2.5631	11.4574	—.3517	8.4574	9.2256	.3806	5.1342	IV
1925	159.4	162.3	.1043	4.74	16.3	.0732	4.5321	—.0770	1.5321	2.8447	.0204	7.2956	IV
1926	150.7	152.1	.1178	5.41	17.4	.4037	5.9850	—.1543	2.9850	4.7587	.0753	5.7762	IV

[1] See footnote to Table XIX concerning the number of price quotations.

[2] All the measures in this table have been computed from the logarithms of relative prices. The averages and the indexes of dispersion given in the table are the antilogarithms of the corresponding logarithmic measures. The standard deviations and the coefficients of variation are given as derived directly from the logarithms. The criteria of curve type relate to the logarithmic distributions.

[3] See page 257 for explanation of the index of dispersion.

TABLE XXIII

MEASURES DESCRIPTIVE OF FREQUENCY DISTRIBUTIONS OF UNWEIGHTED LINK RELATIVES OF COMMODITY PRICES AT WHOLESALE, IN THE UNITED STATES, 1913-1926[1]

(Arithmetic Measures)

(1) Year	(2) Mean	(3) Chain index (from means)	(4) Median	(5) Chain index (from medians)	(6) Standard deviation	(7) $\frac{.6745\sigma}{M}$ x100	(8) β_1	(9) β_2	(10) Skewness	(11) Kurtosis	(12) κ_1	(13) κ_2	(14) r	(15) Pearsonian curve type
1913	100.0	100.0	100.0	100.0										
1914	100.0	100.0	99.6	99.6	13.06	8.8	8.9019	23.5430	.7160	20.5430	14.3804	1.6161	5.6915	VI
1915	108.7	108.7	101.5	101.2	41.75	25.9	67.0945	87.5590	14.1409	84.5590	—32.1655	—28.7113	—3.6308	I_J
1916	127.6	138.7	119.8	121.2	32.07	17.0	12.8927	28.3436	1.0164	25.3436	12.0092	3.5299	7.2200	VI_J
1917	138.0	191.4	135.0	163.6	26.63	13.0	.1928	4.6691	.1277	1.6691	2.7598	.0568	7.5577	IV
1918	117.0	224.0	116.8	191.1	23.16	13.3	.2063	4.8084	.1285	1.8084	2.9978	.0563	7.2093	IV
1919	107.3	240.3	106.5	203.5	25.93	16.3	2.1594	12.8999	.2746	9.8999	13.3216	.2270	4.3871	IV
1920	114.1	274.2	109.9	223.6	27.88	16.5	1.6047	6.4206	.4428	3.4206	2.0272	.8416	11.2941	IV
1921	67.4	184.9	67.9	151.8	17.32	17.3	.0510	2.8911	—.1292	—.1089	—.3708	—.1046	—29.7751	I
1922	99.2	183.4	94.9	144.1	19.50	13.3	2.2798	6.7267	.6703	3.7267	.6140	4.3767	33.6885	VI
1923	107.9	197.9	106.8	153.9	15.59	9.7	.8909	8.1655	.1990	5.1655	7.6585	.1209	4.9159	IV
1924	99.5	196.9	98.9	152.1	14.25	9.7	13.3939	38.2291	.7412	35.2291	30.2766	1.6676	4.7235	VI
1925	105.2	207.1	102.7	156.2	16.20	10.4	12.4661	30.2420	.8705	27.2420	17.0857	2.4119	5.8912	VI_J
1926	96.4	199.6	97.1	151.7	10.84	7.6	.2045	7.6964	—.0856	4.6964	8.7793	.0221	4.4367	IV

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[1] The numbers of price quotations for the different years were as follows:

1913-1917:	391
1918-1919:	389
1920-1022:	391
1923-1924:	390
1925:	387
1926:	385

TABLE XXIV

Measures Descriptive of Frequency Distributions of Weighted Link Relatives of Commodity Prices at Wholesale, in the United States, 1913-1926[1]

(Arithmetic Measures)

(1) Year	(2) Mean	(3) Chain index (from means)	(4) Median	(5) Chain index (from medians)	(6) Standard deviation	(7) $\frac{.6745\sigma}{M}$ x100	(8) β_1	(9) β_2	(10) Skewness	(11) Kurtosis	(12) κ_1	(13) κ_2	(14) r	(15) Pearsonian curve type
1913	100.0	100.0	100.0	100.0										
1914	98.3	98.3	99.3	99.3	10.28	7.1	.0572	8.9118	—.0405	5.9118	11.6520	.0049	4.0446	IV
1915	102.4	100.6	99.2	98.5	21.29	14.0	106.3636	218.5702	2.5637	215.5702	112.0496	20.9847	5.9548	VIJ
1916	128.4	129.2	120.4	118.6	30.86	16.2	8.8848	21.8054	.7913	18.8054	10.9564	2.0596	6.5280	VI
1917	140.9	182.1	138.9	164.8	25.63	12.3	.3344	4.4861	.1895	1.4861	1.9690	.1405	9.6040	IV
1918	113.7	207.0	114.9	189.4	22.77	13.5	.1528	4.9462	—.1048	1.9462	3.4340	.0363	6.6279	IV
1919	108.5	224.7	107.3	203.2	19.24	12.0	1.0245	7.2402	.2462	4.2402	5.4069	.1919	5.7878	IV
1920	113.1	254.1	109.2	221.8	27.16	16.2	1.3927	6.2127	.3966	3.2127	2.2473	.6361	10.1989	IV
1921	67.5	171.5	65.9	146.1	17.97	18.0	.1777	2.6842	.3571	—.3158	—1.1647	—.1208	—7.7608	I
1922	102.6	175.9	98.5	144.0	19.45	12.8	2.3182	6.9266	.6446	3.9266	.8986	3.0625	24.0935	VI
1923	106.2	186.9	104.9	151.0	17.34	11.0	.2557	2.3434	1.1423	—.6566	—2.0803	—.1019	—3.1371	I
1924	98.2	183.5	98.0	148.0	12.05	8.3	2.2712	19.4988	.2265	16.4988	26.1840	.1542	3.7185	IV
1925	107.3	197.0	104.1	154.1	22.19	13.9	11.7941	24.4515	1.1093	21.4515	7.5207	4.7329	9.3002	VIJ
1926	95.4	187.9	97.0	149.5	12.07	8.5	.0785	5.0592	—.0713	2.0592	3.8829	.0164	6.1511	IV

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[1] See footnote to Table XXIII concerning the number of price quotations.

TABLE XXV

Measures Descriptive of Frequency Distributions of Unweighted Link Relatives of Commodity Prices at Wholesale, in the United States, 1891-1926[1]

(Geometric and Logarithmic Measures)[2]

(1) Year	(2) Mean	(3) Chain index (from means) 1913=100	(4) Median	(5) Chain index (from medians) 1913=100	(6) Standard deviation	(7) Coefficient of variation	(8) Index of dispersion[3]	(9) β_1	(10) β_2	(11) Skewness	(12) Kurtosis	(13) κ_1	(14) κ_2	(15) r	(16) Pearsonian curve type
1891	99.3	87.8	99.2	90.0	.0565	2.83	8.8	.0610	3.9947	.0814	.9947	1.8065	.0261	9.7439	IV
1892	94.5	83.0	95.8	86.2	.0487	2.47	7.6	.7541	6.0188	—.2363	3.0188	3.7752	.1862	6.7779	IV
1893	99.5	82.5	98.8	85.2	.0529	2.65	8.3	.7248	5.6271	.2484	2.6271	3.0798	.2154	7.6023	IV
1894	90.0	74.2	90.9	77.4	.0500	2.56	7.8	.1629	4.5092	—.1206	1.5092	2.5295	.0517	7.9373	IV
1895	98.1	72.8	98.0	75.9	.0580	2.91	9.0	.1065	6.1970	.0703	3.1970	6.0746	.0152	5.0280	IV
1896	96.0	69.9	98.5	74.7	.0624	3.15	9.8	.9602	6.4565	—.2644	3.4565	4.0324	.2320	6.6902	IV
1897	99.8	69.7	99.9	74.6	.0666	3.33	10.4	.0834	8.3909	—.0507	5.3909	10.5315	.0077	4.1632	IV
1898	104.3	72.7	102.5	76.5	.0504	2.50	7.8	.2809	4.1813	.1862	1.1813	1.5198	.1501	11.4503	IV
1899	108.5	78.9	105.4	80.6	.0663	3.25	10.3	2.2704	6.2628	.8029	3.2628	—.2856	—9.3488	—62.8684	I
1900	108.4	85.5	107.5	86.6	.0524	2.58	8.2	.0186	4.3841	.0393	1.3841	2.7125	.0053	7.4444	IV
1901	98.8	84.5	98.7	85.5	.0542	2.72	8.5	.5391	4.4468	.2734	1.4468	1.2762	.3622	13.6699	IV
1902	104.2	88.1	103.2	88.2	.0559	2.77	8.7	.1338	6.0266	.0812	3.0266	5.6518	.0203	5.1942	IV
1903	100.2	88.3	101.4	89.5	.0493	2.46	7.7	.4939	4.4075	—.2584	1.4075	1.3332	.3147	13.1122	IV
1904	99.2	87.5	99.9	89.4	.0550	2.76	8.6	.1643	5.4252	—.0996	2.4252	4.3575	.0316	5.8670	IV
1905	101.9	89.2	101.4	90.5	.0435	2.17	6.8	1.1441	10.5852	.1960	7.5852	11.7382	.1156	4.3147	IV
1906	105.4	94.1	105.5	95.6	.0465	2.30	7.3	.4073	5.8378	—.1589	2.8378	4.4536	.0807	5.9688	IV
1907	105.5	99.3	104.6	99.9	.0470	2.32	7.4	.0281	10.0795	.0266	7.0795	14.0748	.0021	3.8586	IV

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[1] The numbers of price quotations for the different years were as follows:

1891-1902:	195	1920-1922:	391
1902-1913:	205	1923-1924:	390
1913-1917:	391	1925:	387
1918-1919:	389	1926:	385

[2] All the measures in this table have been computed from the logarithms of relative prices. The averages and the indexes of dispersion given in the table are the anti-logarithms of the corresponding logarithmic measures. The standard deviations and the coefficients of variation are given as derived directly from the logarithms. The criteria of curve type relate to the logarithmic distributions.

[3] See page 257 for an explanation of the index of dispersion.

TABLE XXV (Cont.)

(1) Year	(2) Mean	(3) Chain index (from means) 1913= 100	(4) Median	(5) Chain index (from medians) 1913=100	(6) Standard deviation	(7) Coefficient of variation	(8) Index of dispersion[3]	(9) β_1	(10) β_2	(11) Skewness	(12) Kurtosis	(13) κ_1	(14) κ_2	(15) r	(16) Pearsonian curve type
1908	93.0	92.4	95.1	95.0	.0586	2.98	9.1	.1308	3.9465	—.1263	.9465	1.5006	.0683	11.2580	IV
1909	102.6	94.8	101.3	96.2	.0458	2.28	7.2	1.8119	8.8948	.3254	5.8948	6.3538	.3345	5.7441	IV
1910	103.9	98.5	102.0	98.1	.0470	2.33	7.4	.0644	6.2217	.0539	3.2217	6.2501	.0089	4.9509	IV
1911	97.7	96.2	98.1	96.2	.0598	3.01	9.3	.7588	8.4300	—.1741	5.4300	8.5837	.0918	4.6632	IV
1912	103.8	99.9	102.9	99.0	.0479	2.37	7.4	.5280	5.7521	.1916	2.7521	3.9203	.1204	6.4650	IV
1913	100.1	100.0	100.9	100.0	.0516	2.58	8.0	.9818	6.7611	—.2557	3.7611	4.5769	.2120	6.2654	IV
1914	99.2	99.2	99.6	99.6	.0525	2.63	8.2	.9344	10.4054	—.1731	7.4054	12.0077	.0901	4.2328	IV
1915	105.4	104.5	101.6	101.2	.0961	4.75	15.0	9.7209	24.8536	.7625	21.8536	14.5445	1.8452	5.8301	VI
1916	124.7	130.2	120.0	121.4	.0884	4.22	13.8	2.0440	7.4567	.4666	4.4567	2.7815	.8477	9.5187	IV
1917	135.4	176.3	134.9	163.8	.0881	4.13	13.8	.7337	7.1119	.1954	4.1119	6.0227	.1186	5.3579	IV
1918	114.8	202.5	117.2	192.0	.0888	4.31	13.9	.4165	5.3597	—.1763	2.3597	3.4700	.1039	6.8183	IV
1919	104.2	211.0	106.6	204.8	.1060	5.25	16.6	.7416	8.3444	—.1728	5.3444	8.4640	.0905	4.6806	IV
1920	111.0	234.3	110.3	225.7	.1005	4.91	15.7	.0174	4.0003	.0424	1.0003	1.9483	.0069	9.1858	IV
1921	65.2	152.8	67.9	153.2	.1167	6.43	18.3	.2850	3.3213	—.2861	.3213	—.2124	—1.0782	—57.5194	I
1922	97.5	149.0	95.0	145.5	.0791	3.98	12.4	.4846	4.2973	.2651	1.2973	1.1409	.3593	14.7917	IV
1923	107.0	159.4	106.9	155.5	.0612	3.02	9.6	.0000	5.0080	.0016	2.0080	4.0159	.0000	5.9881	IV
1924	98.5	157.0	98.9	153.7	.0563	2.82	8.7	1.2416	11.8912	—.1929	8.8912	14.0577	.1117	4.1186	IV
1925	104.3	163.8	102.7	157.8	.0577	2.86	9.0	2.1814	9.8818	.3482	6.8818	7.2194	.3800	5.5687	IV
1926	95.7	156.8	97.1	153.2	.0496	2.51	7.7	.2903	7.8217	—.1028	4.8217	8.7725	.0318	4.4672	IV

TABLE XXVI

Measures Descriptive of Frequency Distributions of Weighted Link Relatives of Commodity Prices at Wholesale, in the United States, 1891-1926[1]

(Geometric and Logarithmic Measures)[2]

(1) Year	(2) Mean	(3) Chain index (from means) 1913=100	(4) Median	(5) Chain index (from medians) 1913=100	(6) Standard deviation	(7) Coefficient of variation	(8) Index of dispersion[3]	(9) β_1	(10) β_2	(11) Skewness	(12) Kurtosis	(13) κ_1	(14) κ_2	(15) r	(16) Pearsonian curve type
1891	100.0	79.5	100.7	81.4	.0676	3.38	10.6	.0566	2.6895	—.1648	—.3105	—.7908	—.0547	—12.3886	I
1892	93.8	74.6	94.1	76.6	.0467	2.37	7.3	.1854	4.7137	—.1234	1.7137	2.8712	.0525	7.3731	IV
1893	101.8	75.9	101.1	77.5	.0530	2.64	8.3	.6744	5.0324	.2722	2.0324	2.0415	.2943	9.8691	IV
1894	89.8	68.1	89.5	69.3	.0510	2.61	7.9	.4334	4.4586	.2296	1.4586	1.6172	.2254	11.2243	IV
1895	101.3	69.1	101.0	70.1	.0627	3.13	9.8	1.0229	5.8938	.3138	2.8938	2.7188	.3628	8.5425	IV
1896	95.3	65.8	97.4	68.2	.0627	3.17	9.8	.9831	6.3465	—.2753	3.3465	3.7436	.2556	6.9934	IV
1897	100.6	66.2	100.8	68.8	.0621	3.10	9.7	.3634	5.7592	—.1499	2.7592	4.4281	.0717	5.9562	IV
1898	102.6	67.9	101.9	70.1	.0497	2.47	7.7	.0011	3.5917	.0121	.5917	1.1802	.0007	13.1706	IV
1899	107.1	72.7	105.9	74.2	.0671	3.30	10.5	1.2351	6.2151	.3492	3.2151	2.7250	.4548	8.7635	IV
1900	108.5	78.9	105.7	78.4	.0539	2.65	8.4	.4769	3.3912	.4331	.3912	—.6482	—.6192	—17.7202	I
1901	99.2	78.3	99.2	77.8	.0510	2.55	7.9	.3115	3.9584	.2176	.9584	.9822	.2577	16.1687	IV
1902	107.3	83.9	106.2	82.6	.0549	2.70	8.6	.0152	5.0909	.0305	2.0909	4.1362	.0030	5.9122	IV
1903	100.8	84.7	102.2	84.5	.0590	2.95	9.2	.1808	2.7771	—.3231	—.2229	—.9882	—.1445	—9.6924	I
1904	99.6	84.3	101.0	85.3	.0657	3.29	10.2	.2298	4.0615	—.1705	1.0615	1.4337	.1284	11.8511	IV
1905	100.6	84.7	100.5	85.7	.0470	2.35	7.4	1.4629	9.7878	.2482	6.7878	9.1870	.1873	4.7839	IV
1906	103.6	87.8	103.4	88.6	.0493	2.45	7.7	.2336	3.0448	.3029	.0448	—.6112	—.3041	—17.7801	I
1907	106.4	93.5	106.2	94.1	.0363	1.79	5.7	.0001	7.5383	.0018	4.5383	9.0763	.00001	4.3221	IV
1908	96.0	89.7	97.8	92.0	.0555	2.80	8.7	.4811	4.9206	—.2160	1.9206	2.3979	.1725	8.6063	IV

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[1] See footnote to Table XXV concerning the number of price quotations.

[2] All the measures in this table have been computed from the logarithms of relative prices. The averages and the indexes of dispersion given in the table are the anti-logarithms of the corresponding logarithmic measures. The standard deviations and the coefficients of variation are given as derived directly from the logarithms. The criteria of curve type relate to the logarithmic distributions.

[3] See page 257 for an explanation of the index of dispersion.

XXVI (Cont.)

(1) Year	(2) Mean	(3) Chain index (from means) 1913=100	(4) Median	(5) Chain index (from medians) 1913=100	(6) Standard deviation	(7) Coefficient of variation	(8) Index of dispersion[3]	(9) β_1	(10) β_2	(11) Skewness	(12) Kurtosis	(13) κ_1	(14) κ_2	(15) r	(16) Pearsonian curve type
1909	106.1	95.2	104.0	95.7	.0487	2.40	7.6	1.3456	6.0588	.3974	3.0588	2.0808	.6568	10.7070	IV
1910	102.9	97.9	101.8	97.3	.0507	2.52	7.9	.0300	4.8460	.0451	1.8460	3.6021	.0064	6.3563	IV
1911	94.5	92.6	95.3	92.8	.0560	2.83	8.7	.3440	10.4929	—.0956	7.4929	13.9538	.0274	3.9339	IV
1912	106.8	98.9	106.8	99.1	.0467	2.30	7.3	.1084	3.6700	.1262	.6700	1.0148	.0828	15.1451	IV
1913	101.1	100.0	100.9	100.0	.0539	2.69	8.4	.0026	5.9896	.0110	2.9896	5.9712	.0004	5.0110	IV
1914	97.9	97.9	99.7	99.7	.0473	2.38	7.4	.4060	5.4619	—.1698	2.4619	3.7058	.0951	6.5668	IV
1915	101.1	98.9	99.2	98.9	.0676	3.37	10.6	3.7787	20.2149	.3251	17.2149	23.0936	.3171	4.0105	IV
1916	125.8	124.5	120.8	119.5	.0876	4.17	13.7	1.7425	5.9061	.5834	2.9061	.5847	3.2122	32.4641	VI
1917	138.6	172.6	139.2	166.3	.0792	3.70	12.4	.0306	3.7486	—.0617	.7486	1.4055	.0166	11.6032	IV
1918	111.7	192.8	115.3	191.7	.0911	4.45	14.2	.3488	4.3688	—.2021	1.3688	1.6914	.1704	10.7134	IV
1919	106.8	205.9	107.4	205.9	.0763	3.76	11.9	.2233	8.1564	—.0866	5.1564	9.6431	.0225	4.3139	IV
1920	110.2	226.9	109.5	225.5	.1004	4.92	15.7	.0124	3.3982	.0450	.3982	.7591	.0124	18.8577	IV
1921	65.4	148.4	66.2	149.3	.1170	6.45	18.3	.0478	2.6504	—.1558	—.3496	—.8425	—.0433	—11.4137	I
1922	101.0	149.9	98.6	147.2	.0753	3.76	11.7	.5303	4.1160	.3044	1.1460	.7010	.6441	22.3876	IV
1923	105.0	157.4	104.9	154.4	.0704	3.48	11.0	.0009	3.1044	.0137	.1044	.2063	.0031	61.1897	IV
1924	97.4	153.3	98.8	152.5	.0530	2.66	8.3	.0031	6.7662	—.0110	3.7662	7.5229	.0004	4.5964	IV
1925	105.8	162.3	104.2	158.9	.0737	3.64	11.5	1.9440	9.0919	.3400	6.0919	6.3518	.3664	5.8074	IV
1926	94.5	153.4	97.1	154.3	.0574	2.91	8.9	.6834	4.6292	—.3139	1.6292	1.2082	.4998	14.6286	IV

TABLE XXVII

MEASURES DESCRIPTIVE OF FREQUENCY DISTRIBUTIONS OF UNWEIGHTED FIXED BASE RELATIVES OF COMMODITY PRICES AT WHOLESALE, IN THE UNITED STATES, 1903—1926[1]

(Arithmetic Measures)
1891=100

(1) Year	(2) Mean	(3) Median	(4) Standard deviation	(5) $\frac{.6745\sigma}{M}$ x100	(6) β_1	(7) β_2	(8) Skewness	(9) Kurtosis	(10) κ_1	(11) κ_2	(12) r	(13) Pearsonian curve type
1903	104.0	100.9	26.22	17.0	2.5011	9.9038	.3999	6.9038	6.3043	.5143	6.0936	IV
1904	102.6	100.3	25.10	16.5	1.8897	9.6145	.3126	6.6145	7.5599	.3033	5.3372	IV
1905	104.6	103.2	26.16	16.9	.8634	6.6540	.2349	3.6540	4.7178	.1775	6.0926	IV
1906	110.3	107.3	29.76	18.2	1.7475	7.5671	.3806	4.5671	3.8917	.5009	7.4306	IV
1907	117.0	114.8	33.91	19.5	1.8942	8.4826	.3584	5.4826	5.2826	.4184	6.3473	IV
1908	108.5	105.6	29.60	18.4	2.2482	9.6893	.3665	6.6893	6.6340	.4261	5.8255	IV
1909	112.0	109.2	32.10	19.3	1.0455	6.3106	.2924	3.3106	3.4847	.2941	7.3437	IV
1910	117.3	111.0	39.81	22.9	3.1718	10.0987	.5192	7.0987	4.6820	.9410	7.5953	IV
1911	115.4	109.1	42.49	24.8	12.1065	26.3044	1.0220	23.3044	10.2893	3.6663	7.6961	VI$_J$
1912	120.1	113.6	44.10	24.8	9.8374	21.5830	.9664	18.5830	7.6538	3.4175	8.4237	VI$_J$
1913	119.8	114.1	44.08	24.8	4.2904	11.0411	.7106	8.0411	3.2110	2.1045	10.7456	VI
1914	119.2	112.4	42.36	24.0	3.6061	10.2384	.6115	7.2384	3.6585	1.4331	9.2371	VI
1915	124.1	118.6	46.75	25.4	3.3221	10.8788	.4968	7.8788	5.7913	.8234	6.7930	IV
1916	155.5	143.9	64.31	27.9	5.1349	13.2176	.6992	10.2176	5.0305	1.7914	8.4477	VI
1917	216.0	200.2	109.63	34.2	29.2321	53.2613	1.8567	50.2613	12.8263	14.3879	10.7728	VI$_J$
1918	253.2	238.4	120.24	32.0	11.6566	27.0493	.9110	24.0493	13.1288	2.7370	6.5776	VI$_J$
1919	258.7	244.5	110.16	28.7	4.6364	14.1600	.5437	11.1600	8.4108	.9497	6.0805	IV
1920	295.3	252.5	132.74	30.3	3.1561	9.3541	.5826	6.3541	3.2399	1.3299	9.6262	VI
1921	193.4	177.6	83.95	29.3	1.0920	4.3891	.6039	1.3891	—.4978	—2.0968	—27.6870	I
1922	192.1	183.1	77.08	27.1	.8661	4.2300	.4838	1.2300	—.1383	—5.7143	—102.5553	I
1923	202.2	190.5	83.14	27.7	.8765	3.9137	.6095	.9137	—.8021	—1.0025	—15.2390	I
1924	200.3	189.1	80.59	27.1	1.1941	5.0759	.4788	2.0759	.5695	2.0445	30.3614	VI
1925	209.2	193.3	89.82	28.9	3.8446	11.1334	.5871	8.1334	4.7330	1.2292	7.9723	VI
1926	201.5	185.1	94.26	31.5	5.6250	14.3688	.7079	11.3688	5.8626	1.7823	7.9253	VI

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[1] See Table XIX for measures descriptive of these distributions for the period 1892-1902.

INDEX[1]

American Tel. and Tel. Co., general business index, *45*, *51*, *83*, 85n, 90-1, *93*, *101*, *108*, *117*, *488*.

Amplitude of cycles in commodity prices, see Cyclical variability

Arithmetic measures, and stability of type, 336; frequency distributions, 325-9, 333, *573-6*, *579-80*, *585*, of dispersion, 256, 262, 280-2; of price level changes, 231-8, 239n; standard errors of means, 241-7; standard errors of standard deviations, 260n, 261-2

Artman, C. E., 55

Berglund, Abraham, 62

Beta point, 317n

Bias in index numbers, 233, 235, 238-9

Bond yield, railroad, 43, *45*, *51*, *67*, *83*, 90, 91, *93*, *101*, *108*, 109, *117*, 127, *488*

Bortkiewicz, L. v., 262n

Bowley, A. L., 241, 246, 247, 256, 267n, 337

Boyle, James E., 61, 62, 63

Building materials, regional price differences, 162-7, *186*; see Groups, commodity

Business cycles, and monthly price variability, 372-7; phases of American, 79-81, 437; see also Cyclical movements

Call loans, interest rate on, *45*, *51*, *67*, *83*, 90, 91, *93*, *101*, *108*, *117*

Chain indexes, *232*, *234*, *236*; error in chaining, 231n

Chance, and regularities, 32, 347

Chapman, S. J., 62

Chemicals and drugs, see Groups, commodity

Cloths and clothing, see Groups, commodity

Consistency of sequence of cyclical movements, 134-40, 159; see Inconsistency

Constant prices, during cycles, 80, 81-2, 98, *99*, *116*, 387-95.

Contract prices, 60n

Correlation, 51-2, 60, 120, 122, 127-40, 141, 145, 149, 151-5, 158-9, 190, 209, 245-7, 283-4, 319-20, 348, 355-64, 369

Cost of living index, Douglas, 72; U. S. B. of L. S., regional differences, 187-9

Cournot, A. A., 142n

Criteria of curve type, 227-9, 311-23

Crop years, 41n, 48, *494-6*

Crump, Norman, 255, 256, 262n, 275, 279, 283, 285

Curve types, see Frequency distribution types

Cyclical movements of commodity prices, 76-140, 157-9; correlation among, 127-40, 158-9; correlation with other price movements 151-5; extent of, 387-95; group characteristics of cyclical measures, 386-437; limits of price cycles, 80-1; measurable aspects of, 78, 157-8; method of measuring, 77-90; regional differences in, 201-8; see also Duration, Percentage decline, Percentage rise, Price cycles, Recession, Revival, Sequence, Timing

Cyclical variability, correlation with other measures, 128-30, *152*, *153*, *154*, 155; index of, 78, 85-6, 90, 96-7, 426-31, 437, *519-42*, *548-52*

Darwin, George, 34

Determination, coefficient of, 141, 145, 147, 148n, 149, 151, 209-10, 361-4, 369

Discount rates, regional differences in, 180-6; regional differences in variability, 194-6

Discount rate on 60-90 day commercial paper, 43, *45*, *51*, *67*, *83*, 90-1, *93*, 101, *108*, *117*

Dispersion of prices, 216, 251-86, 325-34, 339, 347, 352n; and displacement, 358-64; and price level changes, 279-86, 356-69; and standard errors of means, 244-5; and variability of individual prices, 358

---

[1] Pages here numbered in italics contain tabular data.

Displacement of prices, 216, 286-311, 366-7; and dispersion, 358-64; and price level changes, 358-64, 369; and variability of individual prices, 358
Douglas, Paul H., 72
Dow-Jones, see Stock prices
Dry goods, regional differences in retail prices, 175, *186*
Duncker, George, 336n
Dun's index, 161n
Duration of cycles in commodity prices, 78, 85n, 89-90, 94-6, *111-4*, 421-6, 437, *519-47*
Duration of decline (cyclical), 78, 89-90, 126-7, 405-13, 436, *519-42*, *568-72*; correlated with other cyclical measures, *128*, 134; regional differences in, 203-8
Duration of rise (cyclical), 78, 89-90, 107-15, 405-13, 436, *519-42*, *558-62*; as percentage of duration of cycle, 108-15; correlated with other measures, *128*, 134, *153*; regional differences in, 203-8

Earnings of American workers, rates of change in, 72-3
Economic series, general, 43, *45*, *51*, *67*, *83*, 90-1, *93*, *101*, *108*, *117*, 127, *488*
Edgeworth, F. Y., 39, 211, 217, 218, 239n, 240n, 254, 256, 279, 337
Elasticity of demand, coefficient of, 142n, 149, 150n
Equilibrium, among prices, 214; and distribution type, 318-23; economic, 76n, 213n, 217, 354
Exceptional commodities, 81, 102

Fabricated goods, variability of prices, 43, *487*
Falkner's index of wholesale prices, 78, 85n, 87n, 408n, 415, 420, 423, 428
Farm prices, regional differences in, 175-80, *186*; variability, 53-5; see also Commodities
Farm products, see Groups, commodity
Federal Reserve Bank of New York, 45n
Federal Reserve Board, 180, 222-3, 251
Federal Trade Commission, 62-4
Fisher, Irving, 218, 233, 238, 245n, 246n, 251, 256, 262n, 265
Fisher, R. A., 322n, 323n, 327, 328n, 355n, 380n, 386n
Fisher's index, 161n
Fixed base relatives, and stability of type, 336; changes in form of frequency distributions, 339-48, 353; frequency distributions, 224-5, 331-4, *573-8*, *585*; in measurement of dispersion, 253-4, 258-267, 270, 281-2; in measurement of price level changes, 230-7, 241-5, 249-50
Flexibility of prices, 140-51; coefficient of, 141-3; coefficient of partial, 143-4; regional differences in, 208-10
Flux, A. W., 248, 275, 337, 338
Food prices, retail, regional differences, *172*, 173; variability, 52
Foods, see Groups, commodity
Frequency distributions, of measures of cyclical price movements, 395-437; of measures of frequency of price change, 379-81, 383-6; of measures of variability, 370-8, 383-6; of price relatives, 219-29, 323-55, 367-8, *573-585*; of trend measures, 381-6
Frequency distribution types, 313-23; see also Population types
Frequency of price changes, 56-60, 156, 379-81, 434, *502-6*; correlation with other measures, 154; regional differences in, 196-8
Fuel and lighting, see Groups, commodity
Fuel prices, retail, regional differences in, 173-5, *186*

Galton, Francis, 267n
Gauss, C. F., 318
Gaussian distribution, 227-9, 239n, 311-2, 316-23, 325-38, 344-8, 353-4, 365, 368
Gay, Edwin F., 32n
Geometric measures, and stability of type, 336; frequency distributions, 325-9, 352n, *577-8*, *581-4*; measures of dispersion, 256-78, 352n; of price level changes, 231-8, 239n, 263, 266-8, 352n; standard errors of means, 241-7; standard errors of standard deviations, 260n, 261-2
Gini, Corrado, 338
Glover, James W., 67n, 68n, 72n

Grains, price variability, 53-5, 61-4; see also Commodities
Groups, commodity, 219; weights by groups, 222-3;
  Building materials, 47, 70, *492, 500, 507, 510-1, 517, 538-9, 546, 551, 556, 561, 566, 571*;
  Chemicals and drugs, 47, 70, *492-3, 500, 505-6, 511, 517-8, 539-40, 546, 551, 556-7, 561, 566-7, 571*;
  Cloths and clothing, 47, 70, *490-1, 498-9, 503-4, 508-9, 514-5, 532-5, 544-5, 549-50, 554-5, 559-60, 564-5, 569-70*;
  Farm products, 47, 48, 70, *485, 489, 495, 497, 502, 507, 512, 528-9, 543, 548, 553, 558, 563, 568*;
  Foods, 47, 48, 70, *489-90, 495-6, 497-8, 502-3, 507-8, 512-4, 529-32, 543-4, 548-9, 553-4, 558-9, 563-4, 568-9*;
  Fuel and lighting, 47, 70, *491, 499, 504, 509, 515-6, 535, 545, 550, 555, 560, 565, 570*;
  House-furnishings, 47, 70, *493, 500-1, 506, 511, 518, 540-1, 547, 551-2, 557, 561-2, 567, 572*;
  Metals and metal products, 47, 70, *491-2, 499-500, 505-6, 509-10, 516-7, 535-7, 545-6, 550-1, 555-6, 560-1, 565-6, 570-1*;
  Miscellaneous, 47, 70, *493, 501, 506, 512, 518, 541-2, 547, 552, 557, 562, 567, 572*

Heterotypic distributions, 313-4, 322-3, 325-34, 336n, 344-5, 354-5, 386
Homogeneity, of price series, 49; of populations, 216, 227, 318-23
House-furnishings, see Groups, commodity

Inconsistency, in timing of recession, 117, 118, *119-25*, 126, 139-40, 435-6, *563-7*; in timing of revival, 99-101, 103-7, 139-40, 436, *553-7*
Index numbers of prices, see Price level
Instability, group, 216-7, 311-58, 364-5; internal, 215-6, 251-311, 364, 369; of distribution types, 318-23; of price level, 214-5, 229-51, 368-9; price, 34, 213-369; relations among measures of, 215, 355-64, 369
International comparisons, frequency of price change, 197; price trends, 199-201; price variability, 190-4

Jevons, W. S., 217, 218

Kelley, Truman L., 319n, 320, 322, 336n
Knoop, Douglas, 62
Kurtosis of distributions, 228-9, 335n, 340

Laplace, P. S., 318
Lehr, Julius, 69n
Link relatives, and stability of type, 336; changes in form of frequency distributions, 348-55; frequency distributions, 224-5, 331-4, *579-84*; in measurement of dispersion 253-4, 258-62, 268-70, 271-7; in measurement of price level changes, 230-7, 241-5, 249-50.
Logarithmic, see Geometric

Macaulay, Frederick R., 45n, 335n
March, Lucien, 279, 280n, 338
Marshall, Alfred, 142
Mean deviation, as measure of monthly variability, 39-40; as measure of regional price differences, 162; as measure of year-to-year variability, 49
Median, in measurement of price level changes, 231-7, 239, *573-85*
Metals and metal products, see Groups, commodity
Mineral products, consistency of price revival, 105; variability of prices, 42, *486*
Mitchell, Wesley C., 31n, 33, 76n, 79n, 80n, 213n, 218, 239n, 240n, 254, 256, 265, 279, 283n, 335n, 337
Modal divergence, 228-9
Mode, and geometric means, 239n, 240n
Moments of frequency distribution, 229, 311-23
Moore, Henry L., 141, 142n, 143-4, 208, 354n

Normal law of error, see Gaussian

Olivier, Maurice, 251n, 338n

Partial flexibility, see Flexibility

Peake, E. G., 64

Peakedness of distributions, see Kurtosis

Pearson, Karl, 227, 228, 288, 312, 313, 314n, 318, 319, 320n, 321, 322n, 323n, 335, 336n, 342n, 348, 365, 368

Peirce, Charles S., 32, 33

Percentage of decline (cyclical), 78, 90, 127, 418-21, 436-7, *519-42*; correlated with other measures, *128*, 134; regional differences in, 203-8

Percentage of rise (cyclical), 78, 90, 115, 413-8, 436-7, *519-42*; correlated with other measures, *128*, 134, *153*; regional differences in, 203-8

Periods in study of cyclical movements, 79-81

Perishability and price variability, 55-6

Persons' index of wholesale prices, 78, 85n

Persons, W. M., 49n

Pig iron production, 43, *45*, *51*, *67*, *83*, 90, 91, *93*, 97, *101*, *108*, *117*, 118, 127

Population of prices, characteristics of, 311-55, 370-439

Population of the U. S., rate of growth, *67*

Population types, 315-6, 339-55, 383-6, 431-3

Price cycles, 77-82, 85n, 95, 110; number of, 91-4, *106-7*, *111-4*, *124-5*, 387-9, 434-7; see also Cyclical movements

Price determination, 140-51

Price level, and displacement, 356-64, 369; and dispersion, 279-86, 356-64, 369; and variability of individual prices, 356-7, 374-6; instability of, 214-5, 217-8; measurement of changes in, 229-51, 263, 266-8, 272-8, 325-34; relation to stability of distribution type, 349-51

Price quotations, described, *443-84*; form of, 35, 48-9, 56n, 57n

Price relatives, illustrated, 38; in combination, 213-369, *573-85*; see, Arithmetic, Geometric, Fixed base, Link

Price system, 31-5, 213-4, 218-9, 437-9; displacement within, 292-8

Probable error, see Reliability

Probabilities, in measurement of price changes, 231n, 240n

Purchasing power, trends in, *67*, 69-72, *507*; method of measuring, 71-2

Range, as measure of variability, 61

Rank correlation, in measurement of price displacement, 287-9

Rates of change, see Trends

Rates of growth and economic equilibrium, 76n

Recession in commodity prices, 115-27, 392-5, *563-7*; see Duration of decline, Percentage of decline, Timing of recession

Reference dates, 78-81

Regional differences, and measurement of changes in price level, 161-211; in discount rates, see Discount rates; in price behavior, 186-211

Reliability, of index numbers, 240-7, 365; of moments, 313-4, 320-3, 347n, 355, 386n; of standard deviations, 260-2

Retail prices, regional differences in, 173-5, *186*; variability, 52-3; see also Commodities

Revival in commodity prices, 97-115, 390-2, 434-5, *553-7*; see Duration of rise, Percentage of rise, Timing of revival

Rhind, A. J., 312n

Rising prices (during cycles), 80, 81-2, 98, *99*, *116*, 387-95.

Sagging prices (during cycles), 80-2, 98-9, *116*, 387-95

Sampling, see Reliability

Sauerbeck index, 64, 246, 247

Schultz, Henry, 142n

Seasonal fluctuations, 39; and cyclical movements, 77, 79

Sequence of change in prices, during recession, 116-26, 137-40; during revival, 99-107, 134-7, 139-40; regional differences in, 202-3, 205-8; see also Timing

Silverstolpe, 256

Skewness of distributions, 228-9, 314, 339-40

Smith, B. B., 141n, 147n

Soule, George, 184

Speculation and variability of prices, 61-2

Stability, see Instability
Standard deviation, as measure of dispersion, 256-7, 280-2; as measure of inconsistency, 99-101; as measure of price variability, 62; as measure of regional difference, 205-8; of distributions of price relatives, *573-85*; of measures of cycle duration, *424*; of measures of cyclical variability, *429*; of measures of duration of rise, *409*; of measures of duration of decline, *412*; of measures of price decline, *421*; of measures of price rise, *416*; of measures of recession, *402*; of measures of revival, *398*; standard errors of, 260-2, *261*
Standard errors, see Reliability
Stock prices, index of industrial (Dow-Jones) 43, *45*, *51*, *67*, *83*, 90, 91, *93*, *101*, *108*, *117*; index of railroad (Macaulay) *45*, *51*, *67*, *101*, *108*, *117*
System of prices, see Price system

Thorp, Willard L., 79n, 80n
Timing of recession, 78-82, 89, *116-7*, *119-23*, 395-405, 434-5, *512-8*, *519-42*, *563-7*; consistency of sequence, 137-40; correlated with other measures, 120, 122, *128*, 132-4, *153*, *154*
Timing of revival, 78-82, 89, *100*, *101*, *103-5*, 395-405, 434-5, *512-8*, *519-42*, *553-7*; consistency of sequence, 134-7, 139-40; correlated with other measures, 120, 122, *128*, 130-2, *153*, *154*
Trends of commodity prices, 65-76, 157, 381-6, *507-11*; and bias in index numbers, 238-9; and cyclical movements, 77, 79, 85-6; and price variability, 41, 49, 50, 62-3, *154*, 155, 159; measures of, correlated with other measures, 154-5; regional differences in, 198-201
Twelve-month displacement, 308-11
Twelve-month link relatives, in measurement of dispersion, 275-8, 352n; in measurement of price changes, 247-51, 352n

United States Bureau of Labor Statistics, 38n, 48-9, 52, 56, 57n, 69, 77, 149, 173, 187, 222-3, 245n, 443n, 485n
United States Bureau of Labor Statistics index of wholesale commodity prices, *67*, 72n, 78, *83*, *87*, 90, 91, *93*, *101*, *108*, *117*, 145n, *146*, 157, 158, 161n, 162, 209, *230-1*, *233*, *235*, 237, 239, 248-50, 272, 274, 374-6, 382, 403, 404, 405, 408-9, 415-18, 420, 423-5, 428-31
United States Bureau of Standards, 162n
United States Department of Agriculture, 146n
United States Department of Commerce, 162n
United States Geological Survey, 165

Variability of prices, 39-64; and dispersion, 358; and displacement, 358; and price level changes, 356-7; and trend, see Trend; correlated with other measures 152, 153, 190; cyclical variability, see Cyclical; frequency of price changes, see Frequency; monthly variability, 39-49, 64, 156-7, 192-4, 370-7, 433-4, *485-96*; other measures of variability, 60-4; regional differences in, 189-94; week-to-week variability, 55-6; year-to-year variability, 49-55, 63, 156, 189-92, 377-8, *497-501*
Vogel, Emanuel H., 76n

Wages, see Earnings
Walras, Léon, 213n
Walsh, C. M., 218
Watkins, G. P., 62
Weights, and stability of type, 336; comparison of weighted and unweighted measures, 231-39; frequency distributions of weighted and unweighted measures, 329-31, 333-4, *573-85*; in measurement of price movements, 221-223, *443-484*
Working, E. J., 151n
Working, Holbrook, 149n, 161n, 208
Wright, Sewall, 141n

Yule, G. U., 262n

Zapoleon, L. B., 175n

Commodities,
  Acid, acetic, *475*
  Acid, citric, *479*
  Acid, muriatic, *114, 475, 492, 500, 505, 511, 517, 539, 546, 551, 556, 561, 566, 571*
  Acid, nitric, *476*
  Acid, phosphate, *478*
  Acid, stearic, *476*
  Acid, sulphuric, 48n, *114, 476, 492, 500, 505, 511, 517, 539, 546, 551, 556, 561, 566, 571*
  Acid, tartaric, *479*
  Alcohol, denatured, *476*
  Alcohol, grain, 97, *112, 479, 492, 500, 505, 511, 518, 539, 546, 551, 556, 561, 566, 571*
  Alcohol, wood, 65, 69, 72, *103, 107, 114, 119, 121, 125, 476, 492, 500, 505, 511, 517, 539, 546, 551, 556, 561, 566, 571*
  Alum, *114, 476, 492, 500, 505, 511, 517, 539, 546, 551, 556, 561, 567, 571*
  Aluminum, 253, *470*
  Ammonia, anhydrous, *476*
  Ammonia sulphate, *478*
  Apples, evaporated, 41n, *111, 456, 490, 494, 496, 498, 503, 507, 513, 531, 544, 549, 554, 558, 564, 569*; fresh, 55, *456*
  Augers, *114, 467, 491, 499, 504, 510, 516, 535, 546, 550, 556, 561, 566, 570*

  Bananas, *456*; retail, *172*, 173

  Bar iron, *104, 105, 106, 111, 119, 121, 123, 124, 125, 468, 492, 499, 500, 505, 510, 516, 536, 545, 550-1, 555, 560, 565, 570-1*
  Barley, 41n, 53, *54, 61*, 62, *63, 64, 112, 443, 489, 494, 495, 497, 502, 507, 512, 528, 543, 548, 553, 558, 563, 568*; farm prices, *53, 54*, 176-9, *186*
  Bars, iron, *468*
  Beans, 41n, *111, 445, 489, 494, 495, 497, 502, 507, 512, 529, 543, 548, 553, 558, 563, 568*; retail, *172*
  Beef, fresh, *45, 51, 58, 67, 83, 92, 94, 95, 96, 100, 103, 106, 108, 113, 116, 119, 121, 124, 126, 449-50, 489, 495, 497, 503, 508, 512, 529, 543, 548, 554, 559, 564, 568*; retail, *52, 172*, 173n

Commodities,
  Beef, salt, *106, 113, 119, 125, 450, 489, 495, 498, 503, 508, 513, 529, 544, 548, 554, 559, 564, 568*
  Blankets, *481, 501, 511*
  Bleaching powder, *477*
  Bones, *478*
  Boots and shoes, 43, 49n, *104, 111, 114, 119*, 255, *459-61, 487, 490, 498, 503, 508-9, 514, 525, 532, 545, 549, 554-5, 559-60, 564, 569-70*
  Borax, *477*
  Bran, *481*
  Bread, *114, 453-4, 489, 495, 497, 502, 507, 513, 530, 544, 548-9, 554, 559, 564, 568-9*; retail, *172*
  Brick, *103, 106, 112, 119, 125*, 163, *164, 186, 473, 492, 500, 505, 510, 517, 538, 546, 551, 556, 561, 566, 571*
  Butter, *112, 113, 451-53, 490, 496, 497, 503, 508, 513, 530, 543-4, 549, 554, 558, 564, 568*; retail, *52, 172*
  Butts, *111, 467, 491, 499, 504, 510, 516, 535, 546, 550, 556, 561, 566, 571*

  Cabbages, 55; retail, *172*, 173n
  Calico, *104, 107, 111, 119, 121, 124, 461, 491, 498, 503, 508, 514, 532, 544, 549, 555, 559, 564, 570*
  Cantaloupes, 55
  Carpets, *104, 114, 120, 481, 493, 501, 506, 511, 518, 540, 547, 551, 557, 562, 567, 572*
  Cattle, *45, 51, 58, 67, 83, 92, 94, 95, 96, 100, 103, 106, 107, 108*, 109, 110, *113, 114, 116, 119, 121, 123, 124, 125, 126*, 127, 255, *444, 485, 489, 495, 497, 502, 507; 512, 519, 528, 543, 548, 553, 458, 563, 568*
  Cement, 163-7, 185, *186*, 206-8, *473, 510*
  Cheese, *113, 453, 490, 496, 497, 503, 508, 513, 530, 543, 549, 553, 559, 564, 568*; retail, *172*
  Chisels, *114, 467, 491, 499, 504, 510, 516, 535, 546, 550, 556, 561, 566, 571*
  Clover seed, *445*

Commodities,
  Coal, anthracite, 42, *45, 51, 58, 67*, 82, *83, 92, 94, 95, 96*, 98, *100, 108, 114*, 115, *116, 126*, 253, *465-6, 486, 491, 499, 504, 509, 515, 522, 535, 545, 550, 555, 560, 565, 570*; retail, 173-5, *186*
  Coal, bituminous, *45, 51, 58, 67, 83, 92, 94, 95, 96, 100, 107, 108, 111, 113, 116, 121, 122, 123, 124, 126*, 127, 190, *191*, 192, *199*, 200, 253, *466, 486, 491, 499, 504, 509, 515-6, 522, 535, 545, 550, 555, 560, 565, 570*; retail, 173-5, *186*
  Cocoa beans, *454*
  Cocoanut oil, *459*
  Cod, *113, 454, 489, 495, 497, 502, 508, 513, 431, 544, 548, 554, 559, 564, 569*
  Coffee, *107, 112, 125, 191, 199, 454, 490, 496, 498, 503, 508, 513, 530, 543, 549, 554, 558, 564, 569*; retail, *172*
  Coke, 42, *45*, 48, *51*, 57, *58, 67, 83, 92, 94, 95, 96, 100, 103, 105, 106, 108, 112, 116*, 118, *119, 125, 126*, 253, *466, 486, 491, 499, 504, 509, 516, 522, 535, 545, 550, 555, 560, 565, 570*
  Copper, ingot, *45, 51, 58, 67, 83, 93, 94, 95, 96, 100, 103, 106, 108, 111, 116, 119, 121, 123, 124, 126, 191, 199*, 253, *470, 486, 492, 500, 505, 510, 516, 523, 537, 545, 550, 555, 560, 565, 570*
  Copper, sheet, *104, 107, 111, 121, 124, 470, 491, 499, 504, 510, 517, 537, 545, 550, 555, 560, 565, 570*
  Copper sulphate, *477*
  Copper, wire, *104, 105, 106, 111, 119, 121, 123, 124, 470, 492, 499, 505, 510, 517, 537, 545, 550, 555, 560, 565, 571*
  Copra, *454*
  Corn, 41n, 53, *54, 63, 64, 111, 443, 485, 489, 494, 495, 497, 502, 507, 512, 528, 543, 548, 553, 558, 563, 568*; farm prices, 53, 54, 176-80, *186*, 187, 189-90, *198*, 199
  Corn, canned, *458*; retail, *172*
  Corn flakes, *172*
  Corn oil, *459*
  Cornstarch, *114, 458, 489, 495, 497, 502, 507, 514, 532, 544, 548, 554, 559, 564, 569*

Commodities,
  Cotton, 41n, 42, *45, 51, 58, 67, 83, 92, 94, 95, 96*, 98, *100, 104, 106, 108, 112, 116, 120, 121, 124, 126*, 190, *191*, 192, *193, 197*, 198, *199*, 200, *445, 485, 489, 494, 495, 497, 502, 507, 512, 520, 529, 543, 548, 553, 558, 563, 568*; farm prices, *53*, 176-80, 185, *186*
  Cotton yarns, *45, 51, 58, 67, 83, 92, 94, 95, 96*, 98, *100, 107, 108, 112, 116, 121, 125, 126, 191*, 192, *193, 197*, 198, *199, 463, 491, 499, 504, 508-9, 515, 533, 544, 550, 554, 559, 565, 569*
  Cottonseed, *445*
  Cottonseed meal, *104, 106, 111, 119, 121, 125, 481, 493, 501, 506, 511, 518, 541, 547, 552, 557, 562, 567, 572*
  Cottonseed oil, 41n, *103, 105, 106, 112, 119, 121, 123, 124, 459, 490, 494, 496, 498, 503, 508, 514, 532, 543, 549, 554, 558, 564, 568*
  Crackers, *114, 454, 489, 495, 497, 502, 507-8, 513, 531, 544, 548, 554, 559, 564, 569*
  Cream of tartar, *479*
  Crushed stone, *474*
  Currants, *111, 456, 490, 496, 498, 503, 508, 513, 531, 544, 549, 553, 558, 563, 569*
  Cutlery, *481, 500, 511*

  Denims, *104, 106, 112, 120, 122, 124, 461, 491, 498, 504, 509, 514, 533, 544, 549, 555, 559, 565, 569*
  Doorknobs, 110, *111, 467, 491, 499, 504, 510, 516, 535, 546, 550, 556, 560, 566, 571*
  Doors, 49n, *114, 474, 492, 500, 505, 510, 517, 538, 546, 551, 556, 561, 566, 571*
  Douglas fir, *471*
  Drillings, *104, 106, 107, 111, 113, 120, 121, 122, 123, 124, 461, 490-1, 498-9, 504, 509, 514, 533, 544, 549-50, 554-5, 559, 565, 569-70*

  Eggs, 41n, *113, 445-6, 489, 494, 495, 497, 502, 507, 512, 529, 543, 548, 553, 558, 563, 568*;
  retail, *52, 172*

COMMODITIES,

- Electricity, 173-5, *186*
- Epsom salts, *479*

- Ferromanganese, *468*
- Files, *114, 467, 491, 499, 504, 509, 516, 536, 546, 550, 556, 561, 566, 571*
- Flannel, cotton, *104, 113, 114, 120, 122, 461, 490, 499, 503, 509, 514, 533, 544, 550, 555, 559, 565, 569*
- Flannel, outing, *175, 186*
- Flannel, wool, *104, 114, 120, 122, 463, 490, 498, 503, 508, 515, 534, 545, 549, 554, 560, 565, 569*
- Flaxseed, 41n, *113, 447, 489, 494, 495, 497, 502, 507, 512, 529, 543, 548, 553, 558, 563, 568*
- Flour, rye, 41n, *113, 455, 490, 494, 496, 498, 503, 508, 513, 508, 513, 531, 544, 549, 554, 559, 564, 569*
- Flour, wheat, 41n, *45, 51, 58, 67, 112, 113, 455, 490, 494, 495, 498, 503, 507, 513, 531, 544, 549, 553-4, 558-9, 564, 569*; retail, *52, 172*
- Formaldehyde, *477*
- Furniture, 49n, 96, *114, 479-80, 493, 501, 506, 511, 518, 540, 547, 551-2, 557, 562, 567, 572*

- Gas, manufactured, 173-5, *186*
- Gasoline, 167-73, 185, *186*, 192-3, 196-7, 201-8, *466*
- Ginghams, *107, 113, 125, 461, 490, 498-9, 503, 508-9, 514, 533, 544, 549, 554-5, 559, 565, 569*;
  - retail, *175, 186*
- Glass, plate, *474, 475, 500, 510*; window, *107, 112, 113, 125, 475, 492, 500, 505, 510, 517, 539, 546, 551, 556, 561, 566, 571*
- Glucose, *457, 508*
- Glycerine, *113, 122, 479, 492, 500, 505, 511, 518, 540, 546, 551, 557, 561, 567, 571*
- Gravel, *474*
- Gum, sap, *471*

- Hammers, *114, 467, 491, 499, 504, 510, 516, 536, 546, 550, 556, 561, 566, 571*

COMMODITIES,

- Hams, *107, 113, 121, 125, 450, 490, 495, 498, 503, 508, 513, 530, 543, 548, 554, 558, 564, 568*;
  - retail, *52, 172*, 173n
- Hay, 41n, *112*, 144-7, *447, 489, 494, 495, 497, 502, 507, 512, 529, 543, 548, 553, 558, 563, 568*;
  - farm prices, *53, 186*, 208-10
- Hemlock, *104, 114, 120, 471, 517, 538, 546, 551, 556, 561, 566, 571*
- Hemp, *483*
- Herring, *114, 454, 490, 496, 498, 502, 508, 513, 531, 444, 548, 554, 559, 564, 569*
- Hides, *38, 103*, 104, *105, 106, 113, 119, 121, 123, 124, 191, 199*, 255, *447, 489, 495, 497, 502, 507, 512, 520, 529, 543, 548, 553, 558, 563, 568*
- Hogs, *103, 105, 106, 112, 119, 121, 123, 124, 444, 485, 489, 495, 497, 502, 507, 512, 519, 528, 543, 548, 553, 558, 563, 568*
- Hollow tile, *474*
- Hominy grits, *457*
- Hops, 41n, *111, 447, 489, 494, 495, 497, 502, 507, 512, 529, 543, 548, 553, 558, 563, 568*
- Hosiery, cotton, 49n, *461, 462, 498, 508*

- Iron ore, 253, *467*

- Jute, *107, 113, 125*, 291, *483, 493, 501, 506, 511, 518, 541, 547, 552, 557, 562, 567, 572*

- Lamb, *450*; retail, *172*
- Lard, *103, 112, 119, 121, 457, 490, 496, 498, 503, 508, 513, 531, 444, 549, 554, 559, 564, 569*;
  - retail, *52, 172*
- Lath, *473*
- Lead, carbonate of, *107, 113, 125, 475, 492, 500, 505, 510, 517, 539, 546, 551, 556, 561, 566, 571*
- Lead, pig, *103, 105, 106, 112, 119, 121, 125, 471, 486, 492, 499, 505, 510, 517, 525, 537, 545, 550, 555, 560, 565, 570*

Commodities,
Lead, pipe, *103, 113, 119, 121*, 253, *471, 487, 492, 499, 504, 510, 517, 526, 537, 545, 550, 555, 560, 565, 570*
Leather, *45, 51, 58, 67, 83, 93, 94, 95, 96*, 98, *100*, 101, *103, 105, 106, 107, 108, 111, 112, 113*, 115, *116, 119, 121, 125, 126*, 255, *482-3, 487, 493, 501, 506, 511, 518, 527, 541, 547, 552, 557, 562, 567, 572*
Lemons, *457*
Lettuce, *55*
Lime, 48n, 56n, *114*, 163, *164, 186, 474, 492, 500, 505, 510, 517, 539, 546, 551, 556, 561, 566, 571*
Linseed meal, *482*
Linseed oil, *107, 113, 125, 475, 492, 500, 505, 510, 517, 539, 546, 551, 556, 561, 566, 571*
Locks, *111, 467, 491, 499, 504, 510, 516, 536, 546, 550, 556, 560, 566, 570*

Macaroni, *172*
Mackerel, *107, 111, 125, 455, 490, 496, 498, 502, 507, 513, 531, 544, 549, 554, 558, 564, 569*
Maple, *104, 112, 471, 492, 500, 505, 510, 517, 538, 546, 551, 556, 561, 566, 571*
Matches, 48n, 56n, *114, 466, 491, 499, 504, 509, 516, 535, 545, 550, 555, 560, 565, 570*
Meal, corn, *107, 113, 114, 125, 457, 490, 496, 498, 503, 508, 513, 531, 544, 549, 553, 559, 564, 568*; retail, *52, 172*
Milk, canned, *453*; retail, *172*
Milk, fresh, *104, 106, 113, 120, 125, 447-8, 489, 495, 497, 502, 507, 512, 521, 529, 543, 548, 553, 558, 563, 568*; retail, *52, 172*
Mill feed, *482*
Molasses, *111, 457, 489, 495, 498, 502, 507, 513, 531, 544, 548, 554, 559, 564, 569*
Muriate of potash, *478*
Muslin, 96, *104, 105, 106, 107, 112, 113, 120, 122, 124, 125, 462, 490-1, 498, 503-4, 508-9, 514, 533, 544, 549, 554-5, 559, 565, 569*
Mutton, *103, 107, 113, 119, 125, 450, 490, 496, 497, 503, 507, 513, 530, 543, 549, 554, 559, 564, 568*

Nails, *104, 106, 111, 120, 121, 124*, 163, *164, 186, 469, 487, 492, 500, 505, 509, 516, 524, 536, 545, 550, 556, 560, 566, 571*
Nappies, 102, *114, 481, 493, 501, 506, 511, 518, 541, 547, 552, 557, 562, 567, 572*
Nut margarine, *172*

Oak, *113, 114, 122, 472, 492, 500, 505, 510, 517, 538, 546, 551, 556, 561, 566, 571*
Oatmeal, *457*
Oats, 41n, 53, *54, 61*, 62, *63, 64, 112, 443, 485, 489, 494, 495, 497, 502, 507, 512, 528, 543, 548, 553, 558, 563, 568*; farm prices, 53, 54, 176-9, *186*; *198*, 199
Oleo oil, *457*
Oleomargarine, *457*; retail, *172*, 173n
Olive oil, *459*
Onions, 41n, 48, 55, 97, *111*, 154, *448, 489, 494, 495, 497, 502, 507, 512, 529, 543, 548, 553, 558, 563, 568*; retail, *172*
Opium, 69, *107, 113, 125*, 126, *479, 493, 500, 506, 511, 518, 540, 546, 551, 556, 561, 566, 571*
Oranges, 55, *475*; retail, *172*
Overcoating, *463*

Pails, 49n, *114, 481, 501, 518, 540, 547, 552, 557, 562, 567, 572*
Palm kernel oil, *477*
Paper, newsprint, *112, 483, 493, 501, 506, 511, 518, 541, 547, 552, 557, 562, 567, 572*; wrapping, 110, *114*, 118, *483, 493, 501, 506, 511, 518, 541, 547, 552, 557, 562, 567, 572*
Paraffin, *483*
Peaches, canned, *455*; fresh, 55
Peanuts, *448*
Peas, canned, *458*; retail, *172*

Commodities,
  Pepper, *113*, *457*, *489*, *495*, *498*, *503*, *507*, *513*, *531*, *544*, *548*, *554*, *559*, *564*, *569*
  Percale, *462*; retail, *175*, *186*
  Peroxide of hydrogen, *479*
  Petroleum, crude, 42, *45*, 46, *51*, 57, *58*, *67*, *83*, *92*, *94*, *95*, *96*, 97, 98, *100*, *104*, *108*, *112*, 115, *116*, *120*, *126*, *191*, *199*, 253, *467*, *486*, *491*, *499*, *504*, *509*, *516*, *522*, *535*, *545*, *550*, *555*, *560*, *565*, *570*; refined, *104*, *111*, *112*, *120*, *467*, *491*, *499*, *504*, *509*, *516*, *535*, *545*, *550*, *555*, *560*, *565*, *570*
  Phenol, *479*
  Phosphate rock, *478*
  Pig iron, 42, *45*, *51*, *58*, *67*, *83*, 84-9, *92*, *94*, *95*, *96*, 97, *100*, 101, *104*, *105*, *106*, 107, *108*, 110, *111*, *116*, 118, *119*, *121*, *123*, *124*, *126*, 134, *191*, *193*, *197*, 198, *199*, 253, *467-8*, *486*, *492*, *500*, *505*, *510*, *516*, *523*, *536*, *545*, *551*, *555-6*, *560*, *565*, *570-1*
  Pine, *104*, *113-4*, *119*, *122*, 163, *164*, *186*, *472-3*, *492*, *500*, *505*, *510-11*, *517*, *538*, *546*, *551*, *556*, *561*, *566*, *571*
  Pineapples, canned, *456*
  Pipe, iron, *469*
  Pitchers, *114*, *481*, *493*, *501*, *506*, *511*, *518*, *541*, *547*, *552*, *557*, *561*, *567*, *572*
  Planes, *114*, *469*, *491*, *499*, *504*, *510*, *516*, *536*, *546*, *550*, *556*, *561*, *566*, *571*
  Plates, *114*, *481*, *493*, *500*, *506*, *511*, *518*, *541*, *547*, *551*, *557*, *562*, *567*, *572*
  Poplar, *107*, *112*, *122*, *125*, *473*, *492* *500*, *505*, *510*, *517*, *538*, *546*, *551*, *556*, *561*, *566*, *571*
  Pork, cured, *107*, *112*, *113*, *125*, 291, *451*, *490*, *496*, *498*, *503*, *508*, *513*, *530*, *543-4*, *549*, *553-4*, *558-9*, *563*, *568-9*; retail, *52*, *172*
  Pork, fresh, *451*; retail, *52*, *172*
  Potash, caustic, *477*
  Potatoes, sweet, 55, *448*
  Potatoes, white, 41n, 42, *45*, *51*, *54*, 55, 56, *58*, *67*, *112*, 148-51, 161n, 190, *191*, *199*, 200, 291, *448*, *485*, *489*, *494*, *495*, *497*, *502*, *507*, *512*, *529*, *543*, *548*, *553*, *558*, *563*, *568*; farm prices, *53*, *54*, 176-9, *186*; retail, *52*, *172*
  Poultry, dressed, *451*; retail, *52*, *172*
  Poultry, live fowls, *445*
  Print cloths, *39*, *40*, 43, *45*, *51*, *58*, 65, *67*, *83*, *92*, *94*, *95*, *96*, 98, *100*, *104*, *106*, *108*, *112*, *116*, *119*, *121*, *125*, *126*, *463*, *487*, *491*, *499*, *504*, *509*, *514*, *524*, *533*, *544*, *550*, *554*, *559*, *564*, *570*
  Prunes, *107*, *111*, *125*, *456*, *490*, *496*, *498*, *502*, *508*, *513*, *531*, *543*, *549*, *554*, *558*, *563*, *569*; retail, *172*
  Putty, *114*, *475*, *492*, *500*, *505*, *510*, *517*, *539*, *546*, *551*, *556*, *561*, *566*, *571*

  Quicksilver, *107*, *112*, *121*, *124*, *471*, *491*, *499*, *505*, *509*, *517*, *537*, *545*, *550*, *555*, *560*, *566*, *570*
  Quinine, 69, *104*, *111*, *120*, *479*, *493*, *500*, *505*, *511*, *518*, *540*, *546*, *551*, *557*, *561*, *567*, *571*

  Raisins, *113*, *456*, *490*, *495*, *498*, *502*, *507*, *513*, *531*, *544*, *549*, *554*, *559*, *564*, *569*; retail, *172*
  Rice, 41n, *107*, *112*, *125*, *449*, *489*, *494*, *495*, *497*, *502*, *507*, *512*, *529*, *543*, *548*, *553*, *558*, *563*, *568*; retail, *172*
  Rolled oats, *172*
  Rope, *107*, *112*, *121*, *123*, *124*, *483*, *493*, *501*, *506*, *511*, *518*, *541*, *547*, *552*, *557*, *562*, *567*, *572*
  Rosin, 65, 69, 72, *107*, *112*, *125*, *475*, *492*, *500*, *505*, *511*, *517*, *539*, *546*, *551*, *556*, *561*, *566*, *571*
  Rubber, *45*, 46, *51*, *58*, *67*, *83*, *93*, *94*, *95*, *96*, 98, *100*, *103*, *106*, *108*, *112*, 115, *116*, *119*, *125*, *126*, *191*, *199*, *483*, *493*, *501*, *506*, *511*, *518*, *541*, *547*, *552*, *557*, *562*, *567*, *572*
  Rye, 41n, 53, *54*, *63*, *64*, *111*, *191*, *199*, 291, *443*, *489*, *494*, *495*, *497*, *502*, *507*, *512*, *528*, *543*, *548*, *553*, *558*, *563*, *568*; farm prices, *53*, *54*, 176-9, *186*

  Salmon, *111*, *455*, *489*, *495*, *497*, *502*, *508*, *513*, *531*, *544*, *548*, *554*, *559*, *564*, *569*; retail, *172*

Commodities,
- Salt, *112, 458, 490, 495, 498, 502, 507, 513, 532, 544, 548, 554, 559, 564, 569*
- Sand, 163, *164, 186, 474*
- Saws, 58, 94, *114, 469, 491, 499, 504, 509, 516, 536-7, 546, 550, 556, 561, 566, 570*
- Sheep, *103, 106, 107, 113, 119, 121, 123, 124,* 126, *445, 489, 495, 497, 502, 507, 512, 520, 528, 543, 548, 553, 558, 563, 568*
- Sheeting, bleached, *104, 106, 112, 120, 121, 122, 125, 481, 493, 501, 506, 511, 518, 540, 541, 547, 551-2, 557, 561, 567, 572*; retail, *175, 186*
- Sheetings, brown, 49n, *104, 106, 107, 111, 112, 119, 120, 122, 125, 463, 491, 498, 503-4, 508-9, 514, 533, 544-5, 549-50, 555, 559, 564-5, 569-70*
- Shingles, *111, 114, 473, 492, 500, 505, 510, 517, 538, 546, 551, 556, 561, 566, 571*
- Shovels, 97, *111, 469, 491, 499, 504, 509, 516, 537, 546, 550, 556, 560, 566, 571*
- Silk, raw, *103, 105, 106,* 109, *113, 114, 119, 121, 123, 124, 191, 199, 465, 491, 499, 504, 508, 515, 521, 535, 544, 550, 554, 559, 564, 569*; spun, *465*
- Silver, *112, 471, 491, 499, 505, 509, 517, 537, 546, 550, 555, 560, 566, 570*
- Sisal, *483*
- Slate, *474*
- Soap, laundry, *483, 484*
- Soda, ash, *477*
- Soda, bicarbonate, *114, 477, 492, 500, 505, 511, 517, 539, 546, 551, 557, 561, 567, 571*
- Soda, carbonate of, *477*
- Soda, caustic, *477*
- Soda, nitrate of, *478*
- Soda, silicate of, *477*
- Soya bean oil, *459*
- Spiegeleisen, *468*
- Spruce, *107, 112, 122, 124, 473, 492, 500, 505, 510, 517, 538, 546, 551, 556, 561, 566, 571*
- Starch, laundry, *103, 114, 119, 484, 493, 501, 506, 511, 518, 542, 547, 552, 557, 562, 567, 572*
- Steel, billets, *45,* 48n, *51, 58, 67, 83, 92, 94, 95, 96, 100, 104, 105, 106, 108, 111, 116,* 118, *119, 121, 123, 124, 126, 469, 487, 492, 500, 505, 510, 516, 526, 537, 545, 551, 556, 560, 565, 571*
- Steel, merchant bars, *469*
- Steel, plates, *469*
- Steel, rails, 43, *45,* 48, *51, 58, 67,* 82, *83, 93, 94, 95, 96,* 98, *100, 108, 114,* 115, *116, 126, 469, 487, 491, 499, 504, 510, 516, 526, 537, 546, 550, 556, 561, 566, 570*
- Steel, sheets, *469, 509*
- Steel, skelp, *469*
- Steel, structural, *469*
- Sugar, granulated, *113, 191,* 192, *199, 458, 489, 495, 497, 503, 507, 514, 532, 544, 549, 554, 559, 564, 569*; retail, *52, 172*
- Sugar, raw, *45, 51, 58,* 65, *67, 113, 191,* 192, *199, 458, 490, 496, 497, 503, 507, 514, 532, 544, 549, 554, 559, 564, 569*
- Suiting, 43, *104, 113, 119, 464, 487, 490, 498, 503, 509, 515, 524, 534, 545, 549, 555, 560, 564, 570*
- Sulphur, *114, 477, 492, 500, 506, 511, 517, 539, 546, 551, 556, 561, 566, 571*

- Tallow, inedible, *103, 105, 106, 113, 119, 121, 123, 124, 477, 492, 500, 506, 511, 518, 539, 546, 551, 556, 561, 566, 571*; edible, *458*
- Tankage, *478*
- Tar, *112, 475, 492, 500, 505, 510, 517, 539, 546, 551, 556, 561, 566, 571*
- Tea, *111, 458, 489, 495, 497, 502, 507, 514, 532, 543, 548, 554, 558, 563, 569*; retail, *172*
- Teacups and saucers, *114, 481, 493, 500, 506, 511, 518, 541, 547, 551, 557, 562, 567, 572*
- Thread, cotton, *114, 463, 490, 498, 503, 508, 514, 533, 545, 550, 555, 560, 565, 570*; linen shoe thread, *114, 465, 490, 498, 503, 508, 515, 534, 545, 549, 555, 560, 565, 570*
- Tickings, *107, 113, 122, 125, 481, 493*

COMMODITIES,
501, 506, 511, 518, 541, 547, 552, 557, 561, 567, 572
Tin, pig, *103, 105, 106, 112, 119, 125, 471, 486, 492, 500, 505, 510, 517, 525, 537, 545, 550, 555, 560, 566, 570*
Tin, plate, *470, 509*
Tin, roofing, *469*
Tobacco, leaf, *449*; plug and smoking, 49n, *114, 484, 493, 501, 506, 511, 518, 542, 547, 552, 557, 562, 567, 572*
Tomatoes, canned, *459*; retail, *172*
Trousering, 49n, *464, 508*
Trowels, 51, 58, 94, *114*, 118, *470, 491, 499, 504, 509, 516, 537, 546, 550, 556, 561, 566, 570*
Tubs, 49n, *114, 481, 501, 518, 541, 547, 552, 557, 562, 567, 572*
Tumblers, *114, 481, 493, 501, 506, 511, 518, 541, 547, 552, 557, 561, 567, 572*
Turpentine, *107, 113, 121, 124, 475, 492, 500, 505, 510, 517, 539, 546, 551, 556, 561, 566, 571*

Underwear, cotton, *463*; wool, *114, 464, 490, 498, 503, 508, 515, 534, 545, 549, 550, 555, 560, 565, 570*

Veal, *451*
Vinegar, *112, 459, 489, 495, 497, 502, 507, 514, 532, 543, 548, 554, 558, 564, 569*
Vises, *104, 111, 120, 470, 491, 499, 504, 510, 516, 537, 546, 550, 556, 560, 566, 571*

COMMODITIES,
Wheat, 41n, 42, *45, 51*, 53, *54, 58, 61*, 62, *63, 64, 67*, 102, *114*, 118, 190, *191, 193, 199*, 200, *444, 485, 489, 494, 495, 497, 502, 507, 512, 528, 543, 548, 553, 558, 563, 568*; farm prices, *53, 54*, 176-80, *186*
Wheat, cereal, *172*, 173
Wire, fence, *104, 106, 112, 119, 121, 124, 470, 492, 499, 505, 509, 516, 537, 545, 550, 556, 560, 566, 570*
Women's dress goods, 49n, *103, 113, 114, 120, 121, 465, 490, 498-9, 503, 508-9, 515, 534, 545, 549, 554-5, 559-60, 564-5, 569-70*
Wood screws, *104, 106, 112, 120, 122, 125, 470, 491, 500, 504, 509, 516, 537, 545, 551, 556, 560, 566, 570*
Woodpulp, *483*
Wool, 42, *103, 113, 119, 191, 199, 449, 485, 489, 495, 497, 502, 507, 521, 529, 543, 548, 553, 558, 563, 568*
Worsted yarns, *103, 104, 105, 106, 112, 113, 119, 121, 124, 125, 465, 491, 499, 504, 508, 515, 534, 544, 549, 554, 559, 564, 569*

Zinc, oxide, *111, 475, 492, 500, 505, 510, 517, 539, 546, 551, 556, 561, 566, 571*
Zinc, sheet, *111*, 396, *471, 491, 499, 504, 510, 517, 537, 545, 550, 555, 560, 565, 571*; slab, *103, 106, 111, 119, 121, 125*, 126, 253, 396, *471, 492, 499, 505, 510, 517, 537, 545, 551, 555, 560, 565, 570*

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